

# LUMBER RIVER BASINWIDE WATER QUALITY PLAN

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# Executive Summary

## North Carolina's Basinwide Approach to Water Quality Management

Basinwide water quality planning is a nonregulatory watershed-based approach to restoring and protecting the quality of North Carolina's surface waters. Basinwide water quality plans are prepared by the NC Division of Water Quality (DWQ) for each of the 17 major river basins in the state. Each basinwide plan is revised at five-year intervals. While these plans are prepared by the DWQ, their implementation and the protection of water quality entail the coordinated efforts of many agencies, local governments and stakeholders in the state. The first basinwide plan for the Lumber River basin was completed in 1994 and the second in 1999.

This document is the third five-year update of the *Lumber River Basinwide Water Quality Plan*. The format of this plan was revised in response to comments received during the first and second planning cycles. DWQ replaced much of the general information in the first plan with more detailed information specific to the Lumber River basin. A greater emphasis was placed on identifying causes and sources of pollution for individual streams in order to facilitate local restoration efforts.

DWQ considered comments from two public workshops held in the basin and subsequent discussions with local resource agency staff and citizens during draft plan development. This input will help guide continuing DWQ activities in the basin.

## Goals of the Basinwide Approach

The goals of basinwide planning are to:

- Identify water quality problems and restore full use to Impaired waters.
- Identify and protect high value resource waters.
- Protect unimpaired waters yet allow for reasonable economic growth.

DWQ accomplishes these goals through the following objectives:

- Collaborate with other agencies to develop appropriate management strategies.
- Assure equitable distribution of waste assimilative capacity.
- Better evaluate cumulative effects of pollution.
- Improve public awareness and involvement.

## Lumber River Basin Overview

The Lumber River basin lies along the North Carolina/South Carolina border at the southeast corner of the state, extending approximately 150 miles from the Sandhills region in southern Moore and Montgomery counties to the Atlantic Ocean coastline in Brunswick County. Streams and rivers in the Lumber River basin (except for the Lockwoods Folly and Shallotte Rivers) flow into South Carolina and are tributaries of the Pee Dee River. Ultimately, the Pee Dee River empties at Winyah Bay near Georgetown and Myrtle Beach, South Carolina.

From 1982 to 1997, urban and built-up land cover increased by 67,000 acres. Uncultivated cropland decreased by 4,000 acres while pastureland remained about the same. Forest and cultivated cropland cover significantly decreased by 30,000 and 41,000 acres, respectively. Most land cover change is accounted for in the Lumber River basin hydrologic units that include rapidly growing areas in Brunswick, Hoke, Moore and Robeson counties.

The Lumber River basin encompasses all or portions of nine counties and 51 municipalities. The overall population of the basin based on the percent of the counties that are partially or entirely in the basin is 304,579, with approximately 92 persons/square mile. The watersheds with an increase in population are near Pinehurst, Laurinburg, Boiling Spring Lakes and Oak Island.

Populations of counties that are wholly or partly contained within the basin increased by over 501,308 people between 1990 and 2000. Hoke, Moore and Robeson counties are growing the fastest in the upper basin, with Brunswick County growing the fastest in the lower basin. The county populations are expected to grow by more than 156,000 by 2020. With the increased population there will be increased drinking water demands and wastewater discharges. There will also be loss of natural areas and increases in impervious surfaces associated with construction of new homes and businesses.

There are 2,232.5 freshwater stream miles, 8,965.9 acres of freshwater, 4,306.6 estuarine acres, and 25.6 miles of Atlantic coastline in the Lumber River basin. There are also countless miles of unmapped small perennial, intermittent and ephemeral streams. The lower Lumber River basin contains extensive wetland communities also. The basin starts in the Sandhills physiographic region with about two-thirds of the basin in the Coastal Plain.

### **Assessment of Water Quality in the Lumber River Basin**

Surface waters are classified according to their best intended uses. Determining how well a waterbody supports its uses (*use support* status) is an important method of interpreting water quality data and assessing water quality.

Surface waters are rated *Supporting and Impaired*. These ratings refer to whether the classified uses of the water (such as water supply, aquatic life and recreation) are being met. For example, waters assessed for aquatic life (Class C for freshwater or SC for saltwater) are rated Supporting if data used to determine use support meet certain criteria. However, if these criteria were not met, then the waters would be rated as Impaired. Waters with inconclusive data are listed as Not Rated. Waters lacking data are listed as No Data. More specific methods are presented in Appendix III.

In previous use support assessments, surface waters were rated fully supporting (FS), partially supporting (PS), not supporting (NS) and not rated (NR). FS was used to identify waters that were meeting their designated uses. Impaired waters were rated PS and NS, depending on their degree of degradation. NR was used to identify waters lacking data or having inconclusive data. The 2002 Integrated Water Quality Monitoring and Assessment Report Guidance issued by the EPA requested that states no longer subdivide the Impaired category. In agreement with this guidance, North Carolina no longer subdivides the Impaired category and rates waters as Supporting, Impaired, Not Rated or No Data.



Use support methods have been developed to assess ecosystem health and human health risk through the development of use support ratings for six categories: aquatic life, fish consumption, shellfish harvesting, recreation, water supply and "other" uses. These categories are tied to the uses associated with the primary classifications applied to NC rivers, streams and lakes. A single water could have more than one use support rating corresponding to one or more of the six use support categories. For many waters, a use support category will not be applicable (N/A) to the use classification of that water (e.g., shellfish harvesting is only applied to Class SA waters). A full description of the classifications is available in the DWQ document titled: *Classifications and Water Quality Standards Applicable to Surface Waters of North Carolina*. For more detailed information regarding use support methodology, refer to Appendix III.

### **Aquatic Life**

The aquatic life use support category is applied to all waters in North Carolina. Therefore, this category is applied to all 2,232.5 freshwater stream miles, 8,965.9 acres of freshwater, 4,306.6 estuarine acres, and 25.6 miles of Atlantic coastline in the Lumber River basin. Approximately 32 percent of stream miles (723.1 miles) were monitored. Approximately 99 percent of freshwater acres (8,875.3) and 50 percent of estuarine acres (2,170.0 acres) were monitored. There were no Impaired stream miles, freshwater acres or estuarine acres. Table 1 summarizes aquatic life use support ratings for the entire basin.

Table 1      Aquatic Life Use Support Summary Information for Waters in the Lumber River Basin (1996-2001)

<b>Aquatic Life Use Support Ratings</b>	<b>All Waters</b>	<b>Percent of All Waters</b>	<b>Monitored Waters</b>	<b>Percent of Monitored Waters</b>
<b>Supporting</b>	451.9 miles 8,875.3 acres 2,170.0 Est. acres	20.2 99.0 50.4	447.6 miles 8,875.3 acres 2,170 Est. acres	61.9 100.0 100.0
<b>Impaired</b>	0 miles 0 acres 0 Est. acres	0 0 0	0 miles 0 acres 0 Est. acres	0 0 0
<b>Not Rated</b>	299.4 miles 0 acres 0 Est. acres	12.0 0 0	275.5 miles 0 acres 0 Est. acres	38.1 0 0
<b>No Data**</b>	1,481.2 miles 90.6 acres 2,136.5 Est. acres	68.0 1.0 49.6	N/A N/A N/A	N/A N/A N/A
<b>TOTAL</b>	2,232.5 miles 8,965.9 acres 4,306.6 Est. acres		723.1* miles 8,875.3* acres 2,170.0* Est. acres	

Note: Est. acres indicate saltwater (estuarine) acres; all other acres are freshwater acres.

\* 32.4 percent of all stream miles, 98.9 percent of all freshwater acres, and 50.4 estuarine acres were monitored.

\*\* There are also 25.6 miles of Atlantic coastline with No Data, not added to total mileage.

## **Fish Consumption**

Like the aquatic life use support category, the fish consumption category is also applied to all waters in the state. Approximately 1 percent of stream miles (21.5 miles) and 100 percent of Atlantic coastline miles (25.6 miles) in the Lumber River basin were monitored for the fish consumption use support category during this basinwide cycle. Fish consumption use support ratings are based on fish consumption advice or specific advisories issued by the NC Department of Health and Human Services (NCDHHS). If a limited fish consumption advice, advisory or a no consumption advisory is posted at the time of use support assessment, the water is rated Impaired. A basinwide summary of current fish consumption use support ratings is presented in Table 2.

Table 2 Fish Consumption Use Support Summary Information for Waters in the Lumber River Basin (1996-2001)

<b>Fish Consumption</b>	<b>All Waters</b>	<b>Monitored Waters</b>	<b>Percent Monitored</b>
<b>Supporting</b>	0 miles 0 acres 0 Est. acres	0 miles 0 acres 0 Est. acres	0 0 0
<b>Impaired</b>	2,232.5 miles 8,965.9 acres 4,306.6 Est. acres 25.6 coast	21.5 miles 0 acres 0 Est. acres 25.6 coast	1 0 0 100
<b>Not Rated</b>	0 miles 0 acres 0 Est. acres	0 miles 0 acres 0 Est. acres	0 0 0
<b>TOTAL</b>	2,232.5 miles 8,965.9 acres 4,306.6 Est. acres 25.6 coast	21.5 miles 0 acres 0 Est. acres 25.6 coast	1 0 0 100

Note: Est. acres indicate saltwater (estuarine) acres; all other acres are freshwater acres.

Coast indicates miles of Atlantic coastline in the Lumber River basin.

## **Recreation**

Like the aquatic life use support category, the recreation category is also applied to all waters in the state. Approximately 12 percent of stream miles (262.2 miles) were monitored by DWQ. There were no stream miles Impaired in the recreation use support category. Approximately 99 percent of freshwater acres and 47 percent of estuarine acres were monitored. Table 3 summarizes recreation use support ratings for the entire basin.

Table 3 Recreation Use Support Summary for Waters in the Lumber River Basin (1996-2001)

Recreation	All Waters	Monitored Waters	Percent of Monitored Waters
<b>Supporting</b>	257.1 miles 8,840.2 acres 2,039.2 Est. acres 25.6 coast	257.1 miles 8,840.2 acres 2,039.2 Est. acres 25.6 coast	11.5 98.6 47.4 100
<b>Impaired</b>	0 miles 0 acres 0 Est. acres	0 miles 0 acres 0 Est. acres	0 0 0
<b>Not Rated</b>	5.1 miles 0 acres 0 Est. acres 0 coast	5.1 miles 0 acres 0 Est. acres 0 coast	0.2 0 0 0
<b>No Data</b>	1,970.3 miles 125.7 acres 2,276.3 Est. acres	N/A miles N/A acres N/A Est. acres	N/A N/A N/A
<b>TOTAL</b>	2,232.5 miles 8,965.9 acres 4,306.6 Est. acres 25.6 coast	262.2 miles 8,840.2 acres 2,039.2 Est. acres 25.6 coast	

Note: Est. acres indicate saltwater (estuarine) acres; all other acres are freshwater acres.

Coast indicates miles of Atlantic coastline in the Lumber River basin.

### **Water Supply**

There are 216.7 stream miles currently classified for water supply in the Lumber River basin. All water supply waters are Supporting on an evaluated basis based on reports from DEH regional water treatment consultants.

### **Shellfish Harvesting**

There are 4,280.8 estuarine acres classified for shellfish harvesting (Class SA) in the Lumber River basin. All were monitored during the past five years by DEH Shellfish Sanitation (refer to page 45). Impaired estuarine acres accounted for 15.7 percent of the total estuarine acres in the shellfish harvesting use support category. A basinwide summary of current shellfish harvest use support ratings is presented in Table 4.

Table 4 Shellfish Harvesting Use Support Summary Information for Waters in the Lumber River Basin

Shellfish Harvesting	Monitored Waters	Percent of Monitored
Supporting	673.9 acres	100
Impaired	3,606.9 acres	100
Not Rated	0 acres	100
<b>TOTAL</b>	<b>4,280.8 acres</b>	<b>100</b>

### Impaired Waters

Table 5 presents Impaired waters (in all categories) in the Lumber River basin that were monitored by DWQ within the last five years. The use support category for which a waterbody is Impaired is indicated in the table. Descriptions of Impaired segments, as well as problem parameters, are outlined in Appendix III. Management strategies for each waterbody are discussed in detail in the appropriate subbasin chapter. Maps showing current use support ratings for waters in the Lumber River basin are presented in each subbasin chapter in Section B.

Table 5 Monitored Impaired Waters within the Lumber River Basin (as of 2003)

Waterbody	Subbasin	Chapter in Section B	Classification	Miles	Acres	Use Support Category
Lumber River *	03-07-51	2	C Sw	21.5	0.0	Fish Consumption
Intracoastal Waterway	03-07-59	10	SA	0.0	2,117.6	Shellfish Harvesting
Lockwoods Folly River	03-07-59	10	SA	0.0	606.2	Shellfish Harvesting
Mill Creek	03-07-59	10	SA	0.0	2.0	Shellfish Harvesting
Mullet Creek	03-07-59	10	SA	0.0	5.7	Shellfish Harvesting
Lockwoods Creek	03-07-59	10	SA	0.2	0.0	Shellfish Harvesting
Spring Creek	03-07-59	10	SA	0.0	2.4	Shellfish Harvesting
Shallotte River	03-07-59	10	SA	0.0	647.3	Shellfish Harvesting
The Mill Pond	03-07-59	10	SA	0.0	2.8	Shellfish Harvesting
Sams Branch	03-07-59	10	SA	0.6	0.0	Shellfish Harvesting
The Swash	03-07-59	10	SA	0.0	3.9	Shellfish Harvesting
Shallotte Creek	03-07-59	10	SA	0.0	135.6	Shellfish Harvesting
Saucepan Creek	03-07-59	10	SA	0.0	62.6	Shellfish Harvesting
Jinnys Branch	03-07-59	10	SA	0.0	1.0	Shellfish Harvesting
Goose Creek	03-07-59	10	SA	0.0	4.2	Shellfish Harvesting
Big Gut Slough	03-07-59	10	SA	0.0	0.3	Shellfish Harvesting
Kilbart Slough	03-07-59	10	SA	0.0	0.7	Shellfish Harvesting
Calabash River	03-07-59	10	SA	0.0	3.4	Shellfish Harvesting
Hangman Branch	03-07-59	10	SA	0.0	10.2	Shellfish Harvesting
Atlantic Coastline *	03-07-59	10	SB	25.6	0.0	Fish Consumption

\* Although all waters in the basin are considered Impaired for the fish consumption use support category, only the Lumber River (21.5 miles) and the Atlantic coastline (25.6 miles) were monitored (see page 59).

## **Recommended Management Strategies for Restoring Impaired Waters**

The long-range mission of basinwide planning is to provide a means of addressing the complex problem of planning for increased development and economic growth while maintaining, protecting and enhancing water quality and intended uses of the Lumber River basin's surface waters. Within this basinwide plan, DWQ presents management strategies and recommendations for those waters considered Impaired or that exhibit some notable water quality problem.

Major water quality problems in the basin include habitat degradation, algal blooms, low dissolved oxygen (affecting aquatic life), mercury in fish tissue (affecting fish consumption), and fecal coliform bacteria contamination (affecting shellfish harvesting). Habitat degradation, including sedimentation, streambed scour and streambank erosion, is primarily attributed to nonpoint source pollution (NPS). Sources of nonpoint source pollution include runoff from construction sites, agricultural lands and urban areas, and hydromodification.

For streams degraded by point source pollution, the plan presents a management strategy to reduce the impacts from that pollutant source. The task of quantifying nonpoint sources of pollution and developing management strategies for these Impaired waters is very resource intensive. This task is overwhelming, given the current limited resources of DWQ, other agencies (e.g., Division of Land Resources, Division of Soil and Water Conservation, Cooperative Extension Service, etc.) and local governments.

DWQ plans to further evaluate Impaired waters in the Lumber River basin in conjunction with other agencies that deal with nonpoint source pollution issues and develop management strategies for a portion of these Impaired waters for the next *Lumber River Basinwide Water Quality Plan* (2008).

### **Addressing Waters on the State's 303(d) List**

Section 303(d) of the Clean Water Act requires states to identify waters not meeting standards. EPA must then provide review and approval of the listed waters. A list of waters not meeting standards is submitted to EPA biennially. Waters placed on this list, termed the 303(d) list, require the establishment of total maximum daily loads (TMDLs) intended to guide the restoration of water quality. EPA issued guidance in August 1997 that called for states to develop schedules for developing TMDLs for all waters on the 303(d) list within 8-13 years.

The 303(d) list and accompanying data are updated as the basinwide plans are revised. In some cases, the new data will demonstrate water quality improvement and waters may receive a better use support rating. These waters may be removed from the 303(d) list when water quality standards are attained. In other cases, the new data will show a stable or decreasing trend in overall water quality resulting in the same, or lower, use support rating. Attention remains focused on these waters until water quality standards are met. Currently, there are 11 waters listed on the *North Carolina's 2002 Integrated 305(b) and 303(d) Report* in the Lumber River basin. These waters were listed for fish consumption advisories related to mercury. Several of these waters have not been monitored by DWQ, but still are considered Impaired on an evaluated basis due to the current fish consumption advice from the NC Department of Health and Human Services.

## **Challenges Related to Achieving Water Quality Improvements**

To achieve the goal of restoring Impaired waters throughout the basin, DWQ will need to work more closely with other state agencies and stakeholders to identify and control pollutants. The costs of restoration will be high, but several programs exist to provide funding for restoration efforts. These programs include the Clean Water Management Trust Fund, the NC Agricultural Cost Share Program, the Wetlands Restoration Program and the federally funded Environmental Quality Incentives Program.

With increased development occurring, there will be significant challenges ahead in balancing economic growth with the protection of water quality in this basin. Point source impacts on surface waters can be measured and addressed through the basinwide planning process. Nonpoint sources of pollution can be identified through the basinwide plan, but actions to address these impacts must be taken at the local level. Such actions should include: development and enforcement of local erosion control ordinances; requirement of stormwater best management practices for existing and new development; development and enforcement of buffer ordinances; and land use planning that assesses impacts on natural resources. This basinwide plan presents many water quality initiatives and accomplishments that are underway within the basin. These actions provide a foundation on which future initiatives can be built.

# **Section A**

## **General Basinwide Information**





# Section A - Chapter 1

## Introduction to Basinwide Water Quality Planning

### 1.1 What is Basinwide Water Quality Planning?

Basinwide water quality planning is a nonregulatory, watershed-based approach to restoring and protecting the quality of North Carolina's surface waters. Basinwide water quality plans are prepared by the NC Division of Water Quality (DWQ) for each of the 17 major river basins in the state (Figure A-1 and Table A-1). Preparation of a basinwide water quality plan is a five-year process, which is broken down into three phases (Table A-2). While these plans are prepared by the DWQ, their implementation and the protection of water quality entail the coordinated efforts of many agencies, local governments and stakeholder groups in the state. The first cycle of plans was completed in 1998, but each plan is updated at five-year intervals.

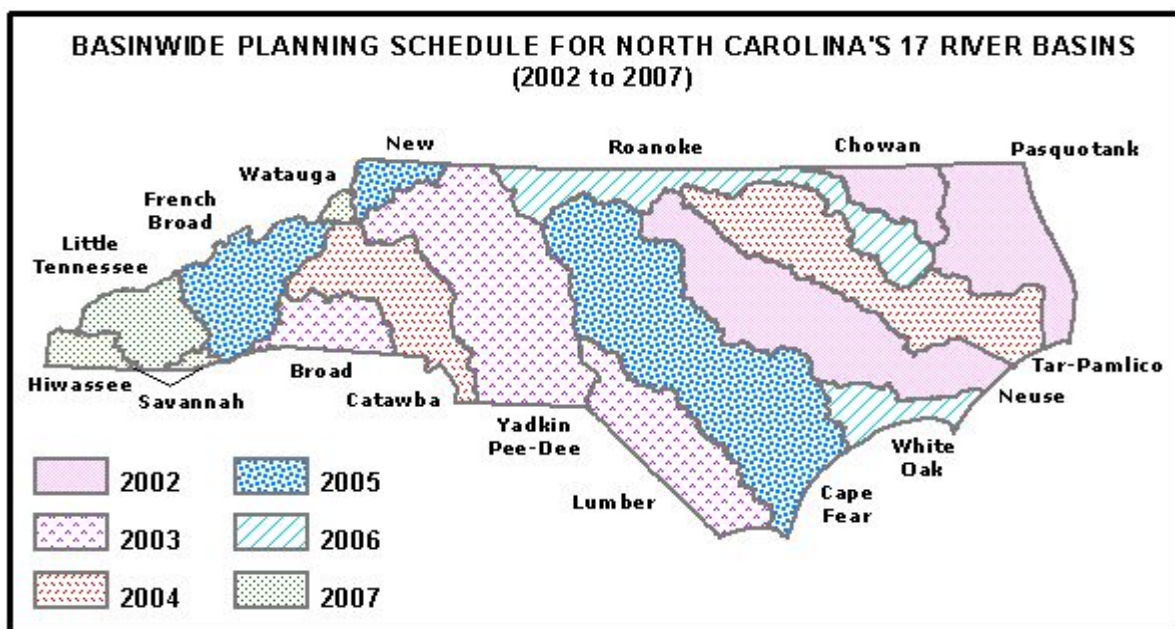


Figure A-1 Basinwide Planning Schedule (2002 to 2007)

### 1.2 Goals of Basinwide Water Quality Planning

The goals of basinwide planning are to:

- Identify water quality problems and restore full use to Impaired waters.
- Identify and protect high value resource waters.
- Protect unimpaired waters yet allow for reasonable economic growth.

DWQ accomplishes these goals through the following objectives:

- Collaborate with other agencies to develop appropriate management strategies.
- Assure equitable distribution of waste assimilative capacity.
- Better evaluate cumulative effects of pollution.
- Improve public awareness and involvement.

Table A-1 Basinwide Planning Schedule (2000 to 2007)

<b>Basin</b>	<b>DWQ Biological Data Collection</b>	<b>River Basin Public Workshops</b>	<b>Public Mtgs. and Draft Out For Review</b>	<b>Final Plan Receives EMC Approval</b>	<b>Begin NPDES Permit Issuance</b>
<b>Chowan</b>	Summer 2000	3/2001	5/2002	7/2002	11/2002
<b>Pasquotank</b>	Summer 2000	3/2001	5/2002	7/2002	12/2002
<b>Neuse</b>	Summer 2000	6/2001	5/2002	7/2002	1/2003
<b>Broad</b>	Summer 2000	11/2001	11/2002	2/2003	7/2003
<b>Yadkin-Pee Dee</b>	Summer 2001	4/2002	1/2003	3/2003	9/2003
<b>Lumber</b>	<b>Summer 2001</b>	<b>12/2002</b>	<b>9/2003</b>	<b>12/2003</b>	<b>7/2004</b>
<b>Tar-Pamlico</b>	Summer 2002	3/2003	12/2003	3/2004	9/2004
<b>Catawba</b>	Summer 2002	10/2003	6/2004	9/2004	12/2004
<b>French Broad</b>	Summer 2002	11/2003	11/2004	2/2005	9/2005
<b>New</b>	Summer 2003	4/2004	5/2005	9/2005	3/2006
<b>Cape Fear</b>	Summer 2003	5/2004	4/2005	8/2005	4/2006
<b>Roanoke</b>	Summer 2004	4/2005	4/2006	8/2006	1/2007
<b>White Oak</b>	Summer 2004	10/2005	9/2006	12/2006	6/2007
<b>Savannah</b>	Summer 2004	10/2005	11/2006	2/2007	8/2007
<b>Watauga</b>	Summer 2004	10/2005	12/2006	3/2007	9/2007
<b>Hiwassee</b>	Summer 2004	10/2005	11/2006	2/2007	8/2007
<b>Little Tennessee</b>	Summer 2004	3/2006	1/2007	4/2007	10/2007

Note: A basinwide plan was completed for all 17 basins during the first cycle (1993 to 1998).

Table A-2 Five-Year Process for Development of an Individual Basinwide Plan

<b>Years 1 - 2</b>  <b>Water Quality Data Collection and Identification of Goals and Issues</b>	<ul style="list-style-type: none"> <li>• Identify sampling needs</li> <li>• Conduct biological monitoring activities</li> <li>• Conduct special studies and other water quality sampling activities</li> <li>• Coordinate with local stakeholders and other agencies to continue to implement goals within current basinwide plan</li> </ul>
<b>Years 2 - 3</b>  <b>Data Analysis and Public Workshops</b>	<ul style="list-style-type: none"> <li>• Gather and analyze data from sampling activities</li> <li>• Develop use support ratings</li> <li>• Conduct special studies and other water quality sampling activities</li> <li>• Conduct public workshops to establish goals and objectives and identify and prioritize issues for the next basin cycle</li> <li>• Develop preliminary pollution control strategies</li> <li>• Coordinate with local stakeholders and other agencies</li> </ul>
<b>Years 3 - 5</b>  <b>Preparation of Draft Basinwide Plan, Public Review, Approval of Plan, Issue NPDES Permits and Begin Implementation of Plan</b>	<ul style="list-style-type: none"> <li>• Develop draft basinwide plan based on water quality data, use support ratings, and recommended pollution control strategies</li> <li>• Circulate draft basinwide plan for review and present draft plan at public meetings</li> <li>• Revise plan after public review period</li> <li>• Submit plan to Environmental Management Commission for approval</li> <li>• Issue NPDES permits</li> <li>• Coordinate with other agencies and local interest groups to prioritize implementation actions</li> <li>• Conduct special studies and other water quality sampling activities</li> </ul>

## 1.3 Major Components of the Basinwide Plan

Each basinwide plan is subdivided into four major sections. The format provides general basinwide information, information by each major watershed, and descriptions of water quality protection initiatives.

### Section A: Basinwide Information

- Introduces the basinwide planning approach used by the state.
- Provides an overview of the river basin including: hydrology, land use, local government jurisdictions, population and growth trends, natural resources, wastewater discharges, animal operations and water usage.
- Presents general water quality information including summaries of water quality monitoring programs and use support ratings in the basin.

### Section B: Subbasin Information

- Summarizes recommendations from previous basin plan, achievements made, what wasn't achieved and why, current priority issues and concerns, Impaired waters, and goals and recommendations for the next five years by subbasin.

### Section C: Current and Future Initiatives

- Presents current and future water quality initiatives and success stories by federal, state and local agencies, and corporate, citizen and academic efforts.
- Describes DWQ goals and initiatives beyond the five-year planning cycle for the basin.

### Appendices

- Lists NPDES dischargers and individual stormwater permits.
- Describes water quality data collected by DWQ, use support methodology and 303(d) listing methodology.
- Provides workshop summaries, points of contact, and a glossary of terms and acronyms.

## 1.4 Benefits of Basinwide Water Quality Planning

Basinwide planning and management benefits water quality by:

- *Focusing resources* on one river basin at a time.
- *Using sound ecological planning and fostering comprehensive NPDES* permitting by working on a watershed scale.
- *Ensuring better consistency and equitability* by clearly defining the program's long-term goals and approaches regarding permits and water quality improvement strategies.
- *Fostering public participation* to increase involvement and awareness about water quality.
- *Integrating and coordinating programs and agencies* to improve implementation of point and nonpoint source pollution reduction strategies.

## 1.5 How to Get Involved

To assure that basinwide plans are accurately written and effectively implemented, it is important for citizens and other local stakeholders to participate in the planning process during:

- Local Workshops: (Prior to the preparation of draft basinwide plans.) DWQ staff present information about basinwide planning and the basin's water quality. Participants can ask questions, share concerns, and discuss potential solutions to water quality issues in the basin.
- Public Meetings: (After the draft plan is prepared.) DWQ staff discuss the draft plan and its major recommendations, seeking public comments and questions.
- Public Comment Period: (After the draft plan is prepared). The comment period is at least 30 days in length. Draft plans are made available on-line or by request.

## 1.6 Other References

There are several reference documents and websites that provide additional information about basinwide planning and the basin's water quality:

- *Lumber River Basinwide Assessment Report*. June 2002. This technical report presents physical, chemical and biological data collected in the Lumber River basin. 146 pages.
- *Lumber River Basinwide Water Quality Management Plan*. May 1994. This first basinwide plan for the Lumber River basin presents water quality data, information and recommended management strategies for the first five-year cycle. 181 pages.
- *Lumber River Basinwide Water Quality Management Plan*. May 1999. This second basinwide plan for the Lumber River basin presents water quality data, information and recommended management strategies for the second five-year cycle. 200 pages.
- *A Citizen's Guide to Water Quality Management in North Carolina*. August 2000. This document includes general information about water quality issues and programs to address these issues. It is intended to be an informational document on water quality. 156 pages.
- *NC Basinwide Wetlands and Riparian Restoration Plan for the Lumber River Basin*. DWQ NC Wetlands Restoration Program.
- *North Carolina's Basinwide Approach to Water Quality Management: Program Description*. Creager, C.S. and J.P. Baker. 1991. DWQ Water Quality Section. Raleigh, NC.
- NC Division of Water Quality Environmental Sciences Branch website at <http://www.esb.enr.state.nc.us/>.

## 1.7 Division of Water Quality Functions and Locations

For more information on the above documents, DWQ activities or contacts, please visit <http://h2o.enr.state.nc.us/basinwide/> or call (919) 733-5083 and ask for the basin planner responsible for your basin of interest. Feel free to contact the appropriate Regional Office for additional information (Figure A-2). For general questions about the Department of Environment and Natural Resources, contact the Customer Service Center at 1-877-623-6748.

**Asheville Regional Office (ARO)**  
Forrest Westall  
WQ Regional Supervisor  
59 Woodfin Place

**Mooresville Regional Office (MRO)**  
Rex Gleason  
WQ Regional Supervisor  
919 North Main Street

**Washington Regional Office (WaRO)**  
Jim Mulligan  
WQ Regional Supervisor  
943 Washington Square Mall



Planning Branch  
Basinwide Planning Program Unit  
November 1, 2003



## Section A - Chapter 2

### Lumber River Basin Overview

#### 2.1 General Overview

The Lumber River basin lies along the North Carolina/South Carolina border at the southeast corner of the state, extending about 150 miles from the Sandhills region in southern Moore and Montgomery counties to the Atlantic Ocean coastline in Brunswick County (Figure A-3).

##### ***Lumber River Basin Statistics***

Total Area: 3,336 sq. miles  
Freshwater Stream Miles: 2,232.5  
Freshwater Lakes Acres: 8,965.9  
Estuarine Acres: 4,305.6  
Coastline Miles: 25.6  
No. of Counties: 9  
No. of Municipalities: 51  
No. of Subbasins: 10  
Population (2000): 304,579\*  
Pop. Density (2000): 92 persons/sq. mi.\*

\* Estimated based on % of county land area that is partially or entirely within the basin.

Streams and rivers in the Lumber River basin (except for the Lockwoods Folly and Shallotte Rivers) flow into South Carolina and are tributaries of the Pee Dee River. Ultimately, the Pee Dee River empties at Winyah Bay near Georgetown and Myrtle Beach, South Carolina. Figure A-4 presents the entire Pee Dee River basin including the Yadkin-Pee Dee and Lumber River basins in North Carolina and the Pee Dee River basin in South Carolina.

The Lumber River basin is the home of Lake Waccamaw and Lumber River State Parks. In Moore and Brunswick counties, world-renowned golf resorts call the Lumber River basin home. In addition, the Lumber River mainstem is the only

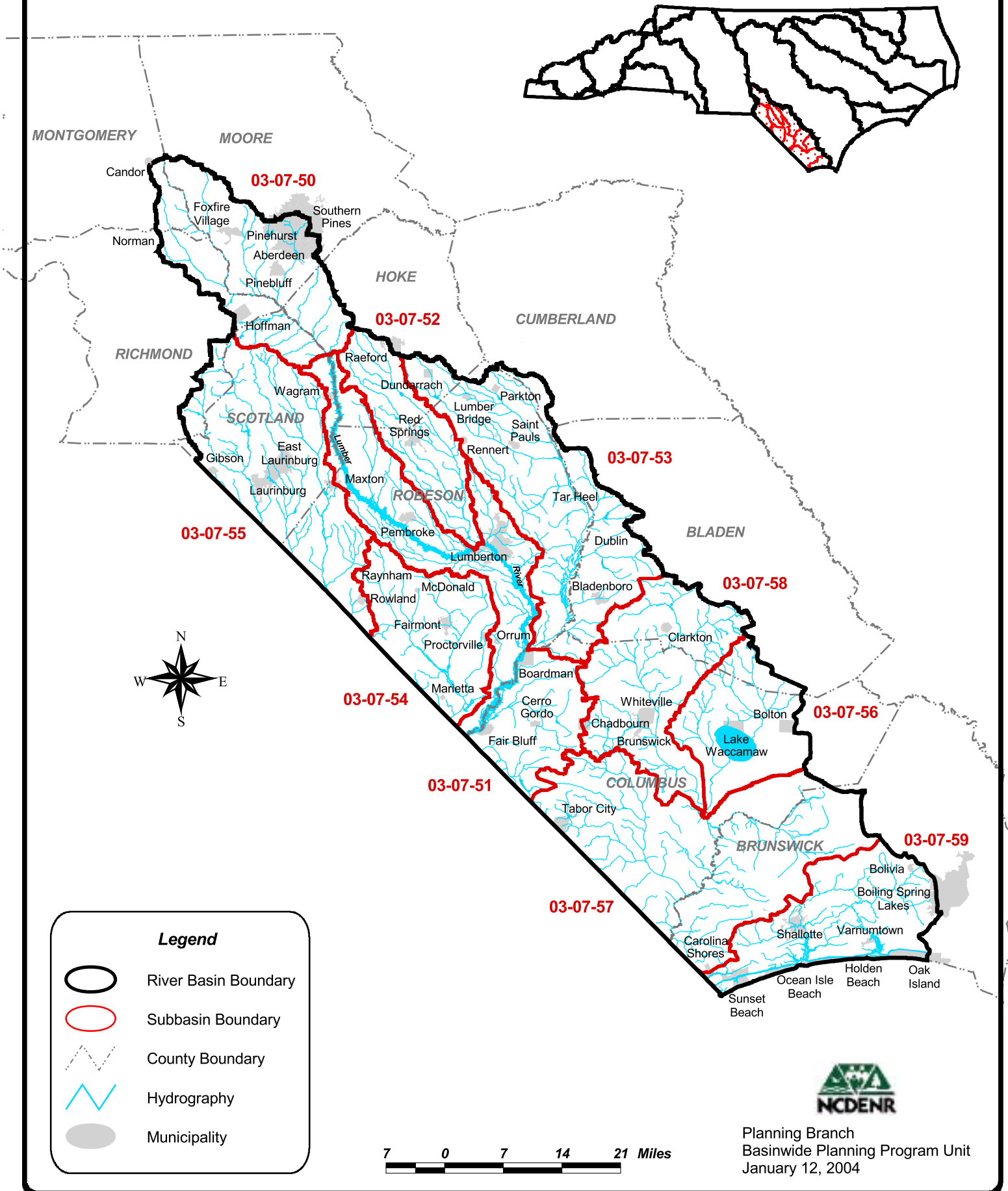
North Carolina blackwater river to earn federal designation as a National Wild and Scenic River. Also, much of the Lumber River mainstem is designated a state Natural and Scenic River, one of just four in North Carolina.

The basin contains all or part of nine counties including: Bladen, Brunswick, Columbus, Hoke, Montgomery, Moore, Richmond, Robeson and Scotland. Population growth for the basin as a whole from 1990 to 2000 is estimated at 18.5 percent.

Sixty percent of the land in the basin is forested, and about 25 percent is cultivated cropland. Tobacco, peanuts, cotton and soybeans are among the most commonly grown crops. Only 7.1 percent of the land falls into the urban/built-up category (USDA-NRCS, NRI, updated June 2001). Despite the large amount of cultivated cropland and the relatively small amount of urban area, the basin has seen a significant decrease (-41,000 acres) in cultivated cropland and (-30,000 acres) in forest and an increase (+67,000 acres) in developed areas over the past 15 years (USDA-NRCS, NRI, updated June 2001).



**Figure A-3 General Map of the Lumber River Basin  
in North Carolina**





**Figure A-4 General Map of the Entire Yadkin-Pee Dee River Basin**

This map illustrates the extensive Yadkin-Pee Dee River Basin, which spans three states: Virginia, North Carolina, and South Carolina. The basin's boundary is delineated by a thick green line. Within this boundary, numerous counties are labeled, including Grayson, Carroll, Patrick, Ashe, Alleghany, Surry, Stokes, Watauga, Wilkes, Yadkin, Forsyth, Guilford, Caldwell, Alexander, Iredell, Davie, S. Davidson, Rowan, Randolph, Moore, Mecklenburg, Union, Richmond, Hoke, Cumberland, Anson, Scotland, Bladen, Lancaster, Chesterfield, Marlboro, Robeson, Columbus, Brunswick, Kershaw, Lee, Darlington, Dillon, Marion, Horry, Sumter, Florence, Williamsburg, Clarendon, and Georgetown. Municipalities are indicated by small gray circles. The river network is shown as blue lines, with major tributaries like the Yadkin, Pee Dee, and Lumber Rivers clearly visible. The map also shows the Atlantic Ocean to the east. A legend in the bottom left corner defines the symbols used: a thick green line for the Basin Boundary, a gray circle for Municipalities, a thin black line for Counties, and a blue line for Rivers. A compass rose indicates North (N), South (S), East (E), and West (W). The source information at the bottom right identifies the organization as NCDENR, DWQ Planning Branch, Basinwide & Estuary Planning Unit, dated September 25, 2002.

**VIRGINIA**

**NORTH CAROLINA**

**SOUTH CAROLINA**

**ATLANTIC OCEAN**

**Legend**

- Basin Boundary
- Municipalities
- Counties
- Rivers

N  
W E  
S

NCDENR  
DWQ Planning Branch  
Basinwide & Estuary Planning Unit  
September 25, 2002

Figure A-4 General Map of the Entire Yadkin-Pee Dee and Lumber River Basins

## **2.2 Surface Water Hydrology**

### **2.2.1 Watershed Descriptions**

DWQ has a two-tiered system in which the state is divided into 17 major river basins with each basin further subdivided into subbasins. The Lumber River basin is divided into 10 subbasins (6-digit DWQ subbasins). Maps of each subbasin are included in Section B. DWQ and many other state agencies in North Carolina use this two-tiered system to identify watersheds for many different programs. Most federal government agencies, including the US Geological Survey (USGS) and the Natural Resources Conservation Service (NRCS), use a different system of defining watersheds. Under the federal system, the Lumber River basin is made up of hydrologic areas referred to as hydrologic units (USGS 8-digit hydrologic units). The Lumber River basin is made up of four whole hydrologic units: the Lumber, Little Pee Dee, Waccamaw and Carolina Coastal-Sampit. Hydrologic units are further divided into smaller watershed units (14-digit hydrologic units) that are used for smaller scale planning like that done by NCWRP (page 147). There are 102 14-digit hydrologic units in the Lumber River basin.

### **2.2.2 Hydrologic Features**

There are 2,232.5 freshwater stream miles, 8,965.9 acres of freshwater acres, 4,305.6 estuarine acres, and 25.6 miles of Atlantic coastline in the Lumber River basin. Most of the Lumber River basin contains extensive wetland communities where 88 percent of the freshwater streams are supplementally classified as swamp waters. There are also areas of the Non-Riverine Swamps and Peatlands ecoregion with flat, poorly drained soils of peat and muck. The basin starts in the Sandhills physiographic region with about two-thirds of the basin in the Coastal Plain region.

Streams in the Sandhills ecoregion are typically swift-flowing sandy streams which receive substantial flow from high quality groundwater during low rainfall periods.

Streams in the coastal plain are slow-moving blackwater streams, low-lying swamps and productive estuarine waters. The Coastal Plain is flat and the larger waterbodies are meandering and often lined with swamps and bottomland hardwoods. The swamp streams often stop flowing in the summer and are stained by tannic acid. These streams have limited ability to assimilate oxygen-consuming wastes. Swamp streams often have naturally low dissolved oxygen and pH values. Coastal Plain soils are deep sands that have a high groundwater storage capacity. Because of the flat topography and high groundwater supply, there are few reservoirs in the Coastal Plain. Natural lakes include the remnants of bay lakes in the lower Coastal Plain.

### **2.2.3 Minimum Streamflow**

One of the purposes of the Dam Safety Law is to ensure maintenance of minimum streamflows below dams. Conditions may be placed on dam operations specifying mandatory minimum releases in order to maintain adequate quantity and quality of water in the length of a stream affected by an impoundment. The Division of Water Resources, in conjunction with the Wildlife Resources Commission, recommends conditions relating to release of flows to satisfy minimum instream flow requirements. The Division of Land Resources issues the permits.

The Resorts of Pinehurst, Inc. operates Lake Pinehurst dam (subbasin 03-07-50) in Moore County on Horse Creek. Lake Pinehurst dam has a minimum flow release of 2.5 cfs or inflow, whichever is less.

Lake Auman (Seven Lakes West) dam is operated by the Seven Lakes West Property Owners Association, Inc. (subbasin 03-07-50). Lake Auman is located in Moore County on an unnamed tributary of Jackson Creek and has a minimum flow release of 2.0 cfs or inflow, whichever is less.

The Pinewild Country Club of Pinehurst operates Holly Course Lake dam (subbasin 03-07-50) in Moore County on Sandy Run Creek. Holly Course Lake dam has a minimum flow release of 0.4 cfs or inflow, whichever is less.

Division of Water Resources conducted a streamflow study for Southern Pines' proposed increase in withdrawal from 4 MGD to 8 MGD from Drowning Creek and found that the increase would not adversely impact downstream habitat. In addition, the town requested a determination, in anticipation of 50-year sales projections, of how much they could exceed the 8 MGD withdrawal. The study determined that, from a physical habitat perspective, withdrawals between 8 MGD and 14 MGD (21.6 cfs) would not be detrimental if a flow target of 36.2 MGD (56 cfs) could be maintained at the downstream US Geological Survey gage at Highway US 1.

#### **2.2.4 Water Withdrawals**

Prior to 1999, North Carolina required water users to register their water withdrawals with the Division of Water Resources (DWR) only if the amount was 1,000,000 gallons or more of surface water or groundwater per day. In 1999, the registration threshold for all water users except agriculture was lowered to 100,000 MGD.

There are six registered water withdrawals in the Lumber River basin not including those associated with the two public water systems discussed below. All of these are surface water withdrawals. Excluding the public water systems or power generating facilities, there is a cumulative permitted capacity to withdraw 10.5 MGD of water. For more information on water withdrawals, visit <http://www.dwr.ehnr.state.nc.us/> or call DWR at (919) 733-4064.

#### **2.2.5 Interbasin Transfers**

In addition to water withdrawals (discussed above), water users in North Carolina are also required to register surface water transfers with the Division of Water Resources if the amount is 100,000 MGD or more. In addition, persons wishing to transfer 2 MGD or more, or increase an existing transfer by 25 percent or more, must first obtain a certificate from the Environmental Management Commission (G.S. 143-215.22i). The river basin boundaries that apply to these requirements are designated on a map entitled *Major River Basins and Sub-Basins in North Carolina*, on file in the Office of the Secretary of State. These boundaries differ from the 17 major river basins delineated by DWQ. The 8-digit hydrologic unit boundaries (Figure A-7) correspond to these basins within the Lumber River basin. Table A-3 summarizes IBTs involving the Lumber River basin.

In determining whether a certificate should be issued, the state must determine that the overall benefits of a transfer outweigh the potential impacts. Factors used to determine whether a certificate should be issued include:

- the necessity, reasonableness and beneficial effects of the transfer;
- the detrimental effects on the source and receiving basins, including effects on water supply needs, wastewater assimilation, water quality, fish and wildlife habitat, hydroelectric power generation, navigation and recreation;
- the cumulative effect of existing transfers or water uses in the source basin;
- reasonable alternatives to the proposed transfer; and
- any other facts and circumstances necessary to evaluate the transfer request.

A provision of the interbasin transfer law requires that an environmental assessment or environmental impact statement be prepared in accordance with the State Environmental Policy Act as supporting documentation for a transfer petition. For more information on water withdrawals, visit <http://www.ncwater.org> or call DWR at (919) 733-4064.

Table A-3 Estimated Interbasin Transfers in the Lumber River Basin (1997)

Supplying System	Receiving System	Source Subbasin	Receiving Subbasin	Estimated Transfer (MGD)
Brunswick County	Ocean Isle Beach	Cape Fear River	Shallotte River	0.386
Brunswick County	Shallotte	Cape Fear River	Shallotte River	0.218

### 2.2.6 Water Supply

The following is summarized from the North Carolina Water Supply Plan developed by the Division of Water Resources (DWR) for the Lumber River basin (NCDENR-DWR, January 2001). The information is compiled from Local Water Supply Plans submitted to DWR by two public water systems. In 1995, the USGS estimated that total water use in the Lumber River basin was 69 MGD, with slightly less than half coming from surface water sources.

Total water use in the Lumber River basin is reported to be approximately 26.9 MGD. Public water systems supplied 11 MGD from surface water. For more information or to view local water supply plans, visit <http://www.dwr.ehnr.state.nc.us/> or call DWR at (919) 733-4064.

## 2.3 Population and Growth Trends

Below are three different ways of presenting population data for the Lumber River basin. Population data presented by county allow for analysis of projected growth trends in the basin based on Office of State Planning information (April and May 2001). Data presented by municipality summarize information on past growth of large urban areas in the basin. While the three different sets of information cannot be directly compared, general conclusions are apparent by looking at the information. Counties with the highest expected growth are associated with the largest municipal areas and the most densely populated watersheds in the basin.

## 2.3.1 County Population and Growth Trends

Table A-4 shows the projected population for 2020 and the change in growth between 2000 and 2020 for counties that are wholly or partly contained within the basin. Since river basin boundaries do not coincide with county boundaries, these numbers are not directly applicable to the Lumber River basin. This information is intended to present an estimate of expected population growth in counties that have some land area in the Lumber River basin.

Table A-4 Past and Projected Population (1990, 2000, 2020) and Population Change by County

County	Percent of County in Basin ♦	1990	2000	Estimated Population 2020	Estimated Pop Change 1990-2000	Estimated Pop Change 2000-2020
Bladen	31	28,663	32,278	38,274	3,615	5,996
Brunswick	55	50,985	73,143	112,885	22,158	39,742
Columbus	89	49,587	54,749	63,283	5,162	8,534
Hoke	43	22,856	33,646	57,891	10,790	24,245
Montgomery	5	23,359	26,822	33,247	3,463	6,425
Moore	21	59,000	74,769	102,828	15,769	28,059
Richmond	19	44,511	46,564	49,825	2,053	3,261
Robeson	100	105,170	123,339	159,552	18,169	36,213
Scotland	99	33,763	35,998	39,932	2,235	3,934
<b>Subtotal</b>		417,894	501,308	657,717	83,414	156,409

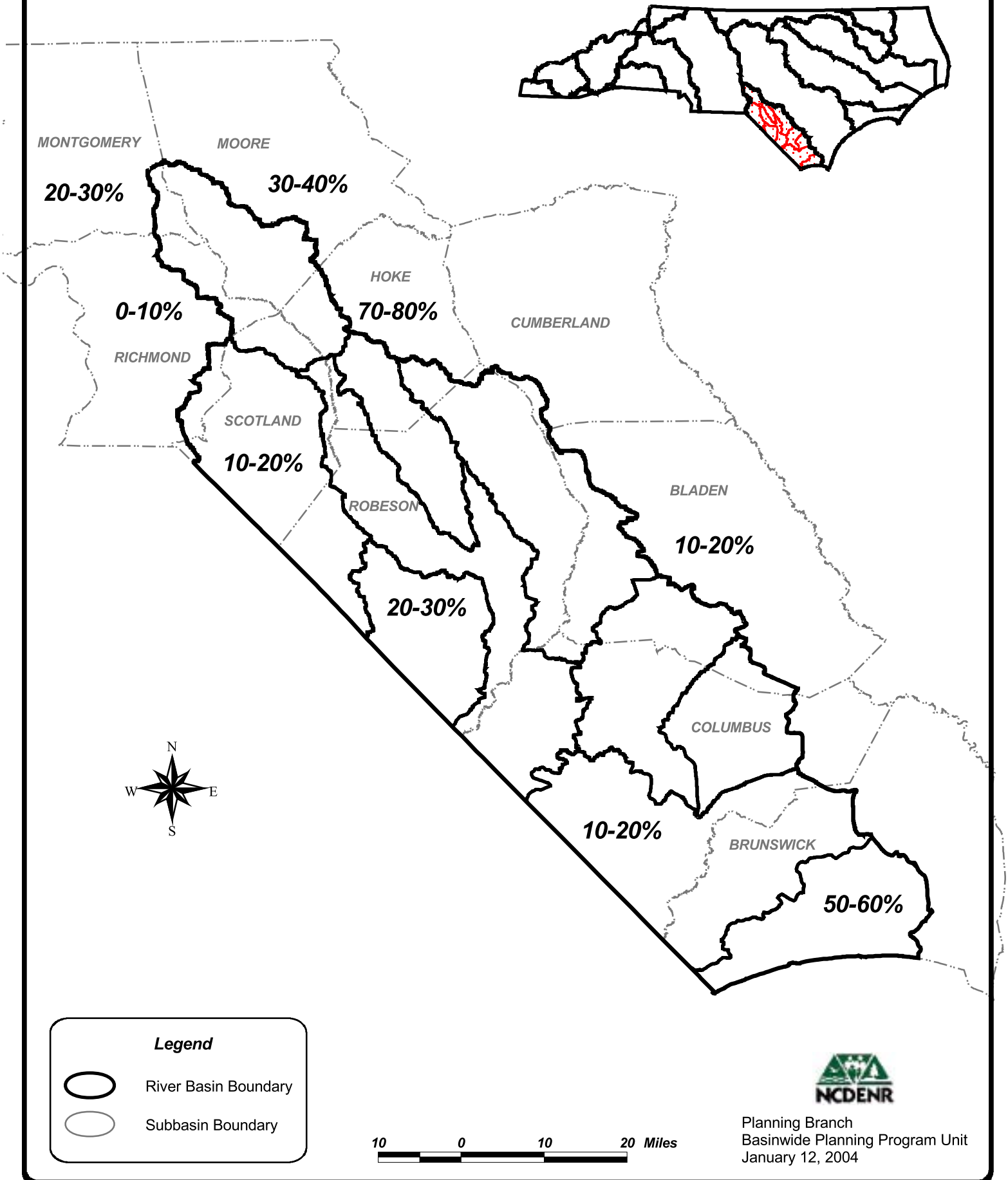
♦ Source: North Carolina Center for Geographic Information and Analysis

Note: The numbers reported reflect county population; however, these counties are not entirely within the basin. The intent is to demonstrate growth for counties located wholly or partially within the basin.

Populations of counties that are wholly or partly contained within the basin increased by 83,414 people between 1990 and 2000. Figure A-5 presents projected population growth by county (2000-2020) for the Lumber River basin. Hoke, Moore and Robeson counties are growing the fastest in the upper basin, with Brunswick County growing the fastest in the lower basin. The county populations are expected to grow by more than 156,000 by 2020. With the increased population there will be increased drinking water demands and wastewater discharges. There will also be loss of natural areas and increases in impervious surfaces associated with construction of new homes and businesses.

For more information on past, current and projected population estimates, contact the Office of State Budget and Management at (919) 733-7061 or visit the North Carolina State Demographics website at <http://demog.state.nc.us/>.

**Figure A-5 Percent Projected County Population Growth (2000-2020)  
in the Lumber River Basin**



### 2.3.2 Municipal Population and Growth Trends

Table A-5 presents population data from Office of State Planning for municipalities with populations greater than 2,000 persons, located wholly or partly within the basin. The highest urban population growth has occurred in the upper basin around Pinehurst and the lower basin around Boiling Spring Lakes. Laurinburg also increased population substantially in the last ten years. In 1999, Long Beach and Yaupon Beach incorporated to become the Town of Oak Island.

Table A-5 Population (1980, 1990, 2000) and Population Change for Municipalities Greater Than 2,000 Located Wholly or Partly in the Lumber River Basin

Municipality	County	Apr-80	Apr-90	Apr-2000	Percent Change (1980-90)	Percent Change (1990-2000)
Aberdeen	Moore	1,945	2,717	3,400	39.7	25.1
Boiling Spring Lakes •	Brunswick	998	1,650	2,972	65.3	80.1
Chadbourn	Columbus	1,975	2,005	2,129	1.5	6.2
Fairmont	Robeson	2,658	2,519	2,604	-5.2	3.4
Laurinburg	Scotland	11,480	11,643	15,874	1.4	36.3
Lumberton	Robeson	18,241	18,733	20,795	2.7	11.0
Maxton	Robeson, Scotland	2,711	2,576	2,551	-5.0	-1.0
Oak Island •	Brunswick	.....	4,550	6,571	.....	44.4
Pembroke	Robeson	2,698	2,241	2,399	-16.9	7.1
Pinehurst •	Moore	1,746	5,091	9,706	191.6	90.7
Raeford •	Hoke	3,630	3,469	3,386	-4.4	-2.4
Red Springs ♦	Robeson	3,607	3,799	3,493	5.3	-8.1
Saint Pauls	Robeson	1,639	1,992	2,137	21.5	7.3
Southern Pines •	Moore	8,620	9,213	10,918	6.9	18.5
Tabor City	Columbus	2,710	2,330	2,509	-14.0	7.7
Whiteville	Columbus	5,565	5,078	5,148	-8.8	1.4

• - The numbers reported reflect municipality population; however, these municipalities are not entirely within the basin.

The intent is to demonstrate growth for municipalities located wholly or partially within the basin.

♦ Note: Red Springs is listed only in Robeson County in the 2001 NC League of Municipalities Directory. However, it is listed in Robeson and Hoke counties on the Office of State Planning website for the April 2001 municipality population data even though there are no population figures listed for Hoke County.

### 2.3.3 Basin Population and Population Density

Most population data are collected from within county or municipal boundaries. It is difficult to evaluate population and population density within watersheds using this information.

Information on population density at a watershed scale is useful in determining what streams are likely to have the most impacts as a result of population growth. This information is also useful in identifying stream segments that have good opportunities for preservation or restoration. The overall population of the Lumber River basin is 304,579, with approximately 92 persons/square mile for counties which are partially or entirely in the basin.



## 2.4 Local Governments and Planning Jurisdictions in the Basin

The Lumber River basin encompasses all or portions of nine counties and 51 municipalities. Table A-6 provides a listing of these municipalities, along with the regional planning jurisdiction (Council of Governments). Eleven municipalities are located in more than one major river basin.

Table A-6 Local Governments and Planning Units within the Lumber River Basin

County	Region	Municipalities
Bladen	N	Bladenboro, Clarkton, Dublin ♦, Tar Heel ♦
Brunswick	O	Boiling Spring Lakes ♦, Bolivia, Calabash, Carolina Shores, Holden Beach, Oak Island ♦, Ocean Isle Beach, Shallotte, Sunset Beach, Varnamtown
Columbus	O	Boardman, Bolton ♦, Brunswick, Cerro Gordo, Chadbourn, Fair Bluff, Lake Waccamaw, Tabor City, Whiteville
Hoke	N	Raeford ♦
Montgomery	G	Candor ♦
Moore	J	Aberdeen, Foxfire Village, Pinebluff, Pinehurst ♦, Southern Pines ♦
Richmond	N	Hoffman ♦, Norman ♦
Robeson	N	Fairmont, Lumber Bridge, Lumberton, Marietta, Maxton *, McDonald, Orrum, Parkton, Pembroke, Proctorville, Raynham, Red Springs, Rennert, Rowland, Saint Pauls
Scotland	N	East Laurinburg, Gibson, Laurinburg, Maxton *, Wagram

\* Located in more than one county.

♦ Located in more than one major river basin.

Note: Counties adjacent to and sharing a border with a river basin are not included as part of that basin if only a trace amount of the county (<2 percent) is located in that basin, unless a municipality is located in that county.

Region	Name	Location
G	Piedmont Triad Council of Governments	Greensboro
J	Triangle J Council of Governments	Durham
N	Lumber River Council of Governments	Lumberton
O	Cape Fear Council of Governments	Wilmington

## 2.5 Land Cover

Land cover can be an important way to evaluate the effects of land use changes on water quality. Unfortunately, the tools and database to do this on a watershed scale are not yet available. Parts 2.5.1 and 2.5.2 below describe two different ways of presenting land cover in the Lumber River basin. The CGIA land cover information is useful in providing a snapshot of land cover in the basin from 1993 to 1995. This information is also available in a GIS format so it can be manipulated to present amounts of the different land covers by subbasin or at the watershed scale. The NRI land cover information is presented only at a larger scale (8-digit hydrologic unit), but the collection methods allow for between year comparisons. The two datasets cannot be compared to evaluate land cover data. This information is presented to provide a picture of the different land covers and some idea of change in land cover over time. In the future, it is hoped that land cover information like the GIS formatted dataset will be developed to make more meaningful assessments of the effects of land use changes on water quality. This dataset would also be useful in providing reliable and small-scale information on land cover changes that can be used in water quality monitoring, modeling and restoration efforts.



## 2.5.1 CGIA Land Cover

The North Carolina Corporate Geographic Database contains land cover information for the Lumber River basin based on satellite imagery from 1993-1995. The state's Center for Geographic Information and Analysis (CGIA) developed 24 categories of statewide land cover information. For the purposes of this report, those categories have been condensed into five broader categories as described in Table A-7. Figure A-6 provides an illustration of the relative amount of land area that falls into each major cover type for the Lumber River basin. Section B of this plan provides land cover data specific to each subbasin based on this information.

Table A-7 Description of Major CGIA Land Cover Categories

Land Cover Type	Land Cover Description
Urban	Greater than 50 percent coverage by synthetic land cover (built-upon area) and municipal areas.
Cultivated Cropland	Areas that are covered by crops that are cultivated in a distinguishable pattern.
Pasture/Managed Herbaceous	Areas used for the production of grass and other forage crops and other managed areas such as golf courses and cemeteries. Also includes upland herbaceous areas not characteristic of riverine and estuarine environments.
Forest/Wetland	Includes salt and freshwater marshes, hardwood swamps, shrublands and all kinds of forested areas (such as needleleaf evergreens, deciduous hardwoods).
Water	Areas of open surface water, areas of exposed rock, and areas of sand or silt adjacent to tidal waters and lakes.

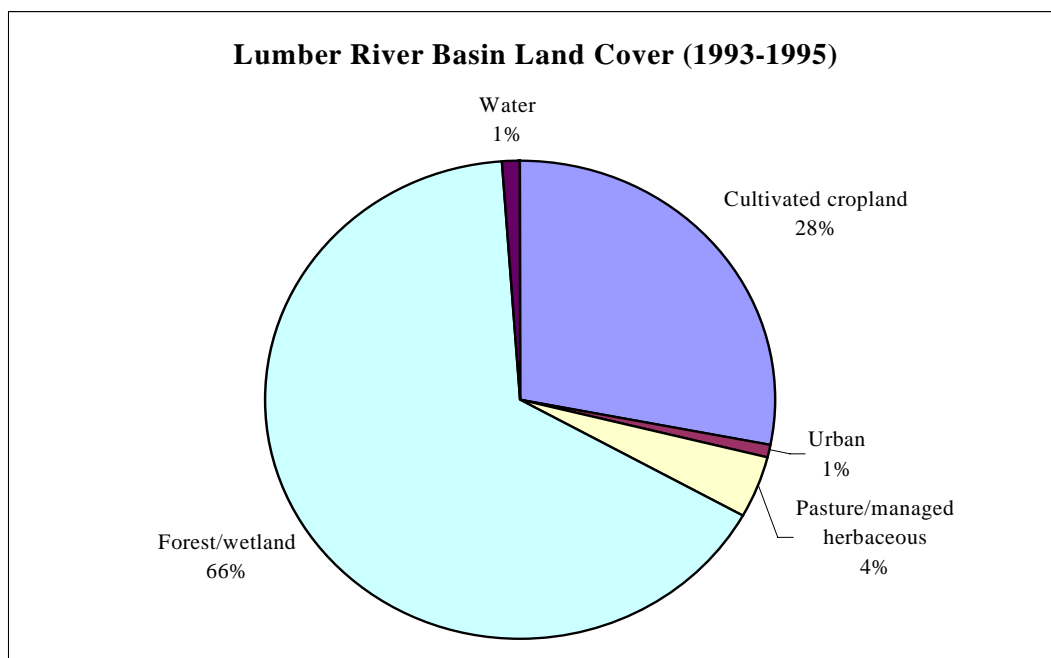


Figure A-6 Percentages within Major CGIA Land Cover Categories in the Lumber River Basin

## 2.5.2 NRI Land Cover Trends

Land cover information in this section is from the most current National Resources Inventory (NRI), as developed by the Natural Resources Conservation Service (USDA-NRCS, NRI, updated June 2001). The National Resources Inventory (NRI) is a statistically based longitudinal survey that has been designed and implemented to assess conditions and trends of soil, water and related resources on the Nation's nonfederal rural lands. The NRI provides results that are nationally and temporally consistent for four points in time -- 1982, 1987, 1992 and 1997.

In general, NRI protocols and definitions remain fixed for each inventory year. However, part of the inventory process is that the previously recorded data are carefully reviewed as determinations are made for the new inventory year. For those cases where a protocol or definition needs to be modified, all historical data must be edited and reviewed on a point-by-point basis to make sure that data for all years are consistent and properly calibrated. The following excerpt from the *Summary Report: 1997 National Resources Inventory* provides guidance for use and interpretation of current NRI data:

*"The 1997 NRI database has been designed for use in detecting significant changes in resource conditions relative to the years 1982, 1987, 1992 and 1997. All comparisons for two points in time should be made using the new 1997 NRI database. Comparisons made using data previously published for the 1982, 1987 or 1992 NRI may provide erroneous results because of changes in statistical estimation protocols, and because all data collected prior to 1997 were simultaneously reviewed (edited) as 1997 NRI data were collected."*

Table A-8 summarizes acreage and percentage of land cover from the 1997 NRI for the major watersheds within the basin, as defined by the USGS 8-digit hydrologic units, and compares the coverages to 1982 land cover. Definitions of the different land cover types are presented in Table A-9. Figure A-7 also shows the relationship between the 8-digit hydrologic units and DWQ subbasin. These data can be used to evaluate changes in land cover over the large area represented by the 8-digit hydrologic units and should not be assumed to represent land cover changes at smaller scales in specific watersheds. In the Lumber River basin, the 8-digit hydrologic units extend into South Carolina, and thus, are partially contained in North Carolina.

Data from 1982 are also provided for a comparison of change over 15 years. During this period, urban and built-up land cover increased by 67,000 acres. Uncultivated cropland decreased by 4,000 acres while pastureland remained about the same. Forest and cultivated cropland cover significantly decreased by 30,000 and 41,000 acres, respectively. Most land cover change is accounted for in the upper Lumber River basin hydrologic unit that includes rapidly growing areas in Hoke, Moore and Robeson counties as well as the lower Lumber River basin hydrologic unit in Brunswick County. Figure A-8 presents changes in land cover between 1982 and 1997.

Table A-8 Land Cover in the Lumber River Basin by Major Watersheds – 1982 vs. 1997  
(Source: USDA-NRCS, NRI, updated June 2001)

LAND COVER	MAJOR WATERSHED AREAS								1997 TOTALS		1982 TOTALS		% change since 1982
	Lumber		Little Pee Dee		Waccamaw		Carolina Coastal- Sampit						
	Acres (1000s)	%	Acres (1000s)	%	Acres (1000s)	%	Acres (1000s)	%	Acres (1000s)	TOTAL	Acres (1000s)	TOTAL	
Cult. Crop	309.6	28.7	76.5	30.9	153.3	22.8	10.1	5.9	549.5	25.3	590.7	27.2	-7.0
Uncult. Crop	12.6	1.2	1.6	0.6	0.0	0.0	0.0	0.0	14.2	0.7	18.2	0.8	-22.0
Pasture	22.0	2.0	5.6	2.3	7.4	1.1	5.3	3.1	40.3	1.9	40.6	1.9	-0.7
Forest	599.4	55.6	138.0	55.7	457.5	68.0	105.9	61.7	1300.8	59.9	1330.3	61.2	-2.2
Urban & Built-Up	81.2	7.5	14.5	5.9	26.0	3.9	32.1	18.7	153.8	7.1	86.5	4.0	77.8
Federal	6.5	0.6	0.0	0.0	0.0	0.0	0.0	0.0	6.5	0.3	6.5	0.3	0.0
Other	46.9	4.3	11.4	4.6	28.2	4.2	18.3	10.7	104.8	4.8	101.8	4.7	2.9
Totals	1078.2	100.0	247.6	100.0	672.4	100.0	171.7	100.0	2169.9	100.0	2174.6	100.0	
% of Total Basin		49.6		11.4		30.9		7.9					
SUBBASINS	03-07-50 03-07-51 03-07-52 03-07-53 03-07-54	03-07-55		03-07-56 03-07-57 03-07-58		03-07-59							
8-Digit Hydraulic Units	03040203		03040204		03040206		03040207						

\* = Watershed areas as defined by the 8-Digit Hydraulic Units do not necessarily coincide with subbasin titles used by DWQ.

Source: USDA, Soil Conservation Service - 1982 and 1997 NRI.

Figure A-7 8-Digit Hydrologic Units in the Lumber River Basin

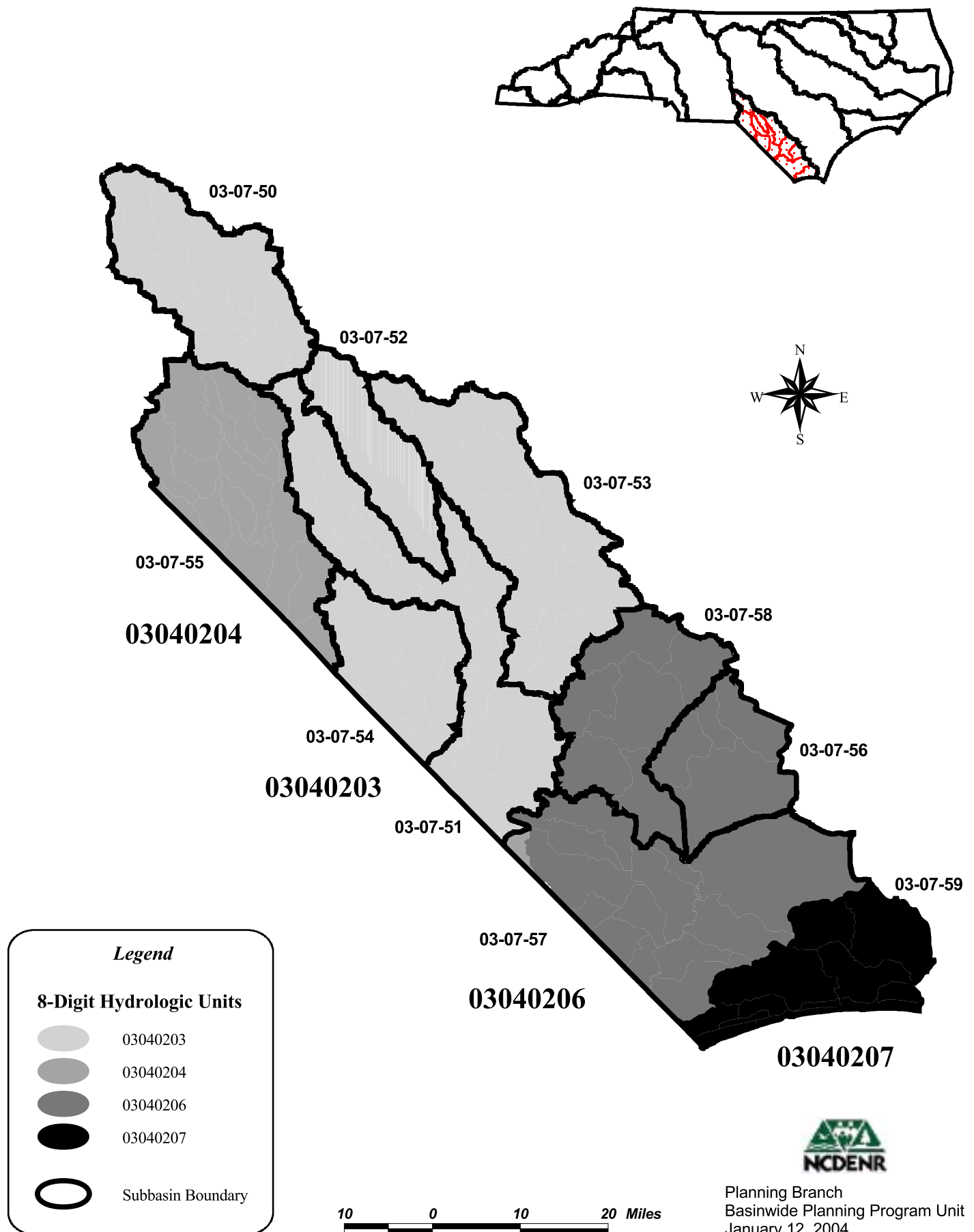


Table A-9 Description of Land Cover Types  
(Source: USDA-NRCS, NRI, updated June 2001)

Type	Description
Cultivated Cropland	Harvestable crops including row crops, small-grain and hay crops, nursery and orchard crops, and other specialty crops.
Uncultivated Cropland	Summer fallow or other cropland not planted.
Pastureland	Includes land that has a vegetative cover of grasses, legumes and/or forbs, regardless of whether or not it is being grazed by livestock.
Forestland	At least 10 percent stocked (a canopy cover of leaves and branches of 25 percent or greater) by single-stemmed trees of any size which will be at least 4 meters at maturity, and land bearing evidence of natural regeneration of tree cover. The minimum area for classification of forestland is 1 acre, and the area must be at least 1,000 feet wide.
Urban and Built-up Areas	Includes airports, playgrounds with permanent structures, cemeteries, public administration sites, commercial sites, railroad yards, construction sites, residences, golf courses, sanitary landfills, industrial sites, sewage treatment plants, institutional sites, water control structure spillways and parking lots. Includes highways, railroads and other transportation facilities if surrounded by other urban and built-up areas. Tracts of less than 10 acres that are completely surrounded by urban and built-up lands.
Other	<p><u>Rural Transportation</u>: Consists of all highways, roads, railroads and associated rights-of-way outside urban and built-up areas; private roads to farmsteads; logging roads; and other private roads (but not field lanes).</p> <p><u>Small Water Areas</u>: Waterbodies less than 40 acres; streams less than 0.5 miles wide.</p> <p><u>Census Water</u>: Large waterbodies consisting of lakes and estuaries greater than 40 acres and rivers greater than 0.5 miles in width.</p> <p><u>Minor Land</u>: Lands that do not fall into one of the other categories.</p>

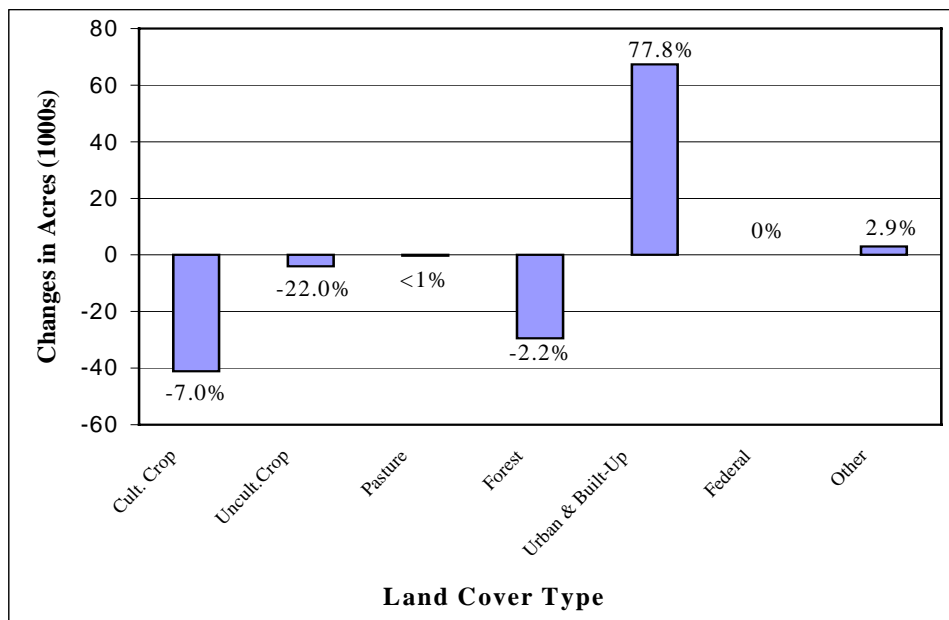


Figure A-8 Land Cover Changes from 1982 to 1997 for the Lumber River Basin  
(Source: USDA-NRCS, NRI, updated June 2001)

## 2.6 NPDES Permits Summary

### ***The primary pollutants associated with point source discharges are:***

- \* oxygen-consuming wastes,
- \* nutrients,
- \* color, and
- \* toxic substances including chlorine, ammonia and metals.

Discharges that enter surface waters through a pipe, ditch or other well-defined point of discharge are broadly referred to as 'point sources'. Wastewater point source discharges include municipal (city and county) and industrial wastewater treatment plants and small domestic wastewater treatment systems serving schools, commercial offices, residential subdivisions and individual homes. Stormwater point source discharges include stormwater collection systems for

municipalities that serve populations greater than 100,000 and stormwater discharges associated with certain industrial activities. Point source dischargers in North Carolina must apply for and obtain a National Pollutant Discharge Elimination System (NPDES) permit. Discharge permits are issued under the NPDES program, which is delegated to DWQ by the Environmental Protection Agency.

### 2.6.1 Permitted Wastewater Discharges

#### ***Types of Wastewater Discharges***

**Major Facilities:** Wastewater Treatment Plants with flows  $\geq 1$  MGD (million gallons per day); and some industrial facilities (depending on flow and potential impacts to public health and water quality).

**Minor Facilities:** Facilities not defined as Major.

**100% Domestic Waste:** Facilities that only treat domestic-type waste (from toilets, sinks, washers).

**Municipal Facilities:** Public facilities that serve a municipality. Can treat waste from homes and industries.

**Nonmunicipal Facilities:** Non-public facilities that provide treatment for domestic, industrial or commercial wastewater. This category includes wastewater from industrial processes such as textiles, mining, seafood processing, glass-making and power generation, and other facilities such as schools, subdivisions, nursing homes, groundwater remediation projects, water treatment plants and non-process industrial wastewater.

Currently, there are 52 permitted wastewater discharges in the Lumber River basin. Table A-10 provides summary information (by type and subbasin) about the discharges. Various types of dischargers listed in the table are described in the inset box. A list of all facilities can be found in Appendix I. Facilities are mapped in each subbasin chapter in Section B. A location key to the facilities is provided at the beginning of Appendix I. Because the GIS data have not been updated as recently as the NPDES database, refer to Appendix I to determine the most current status of individual NPDES permit holders.

The majority of NPDES permitted wastewater flow into the waters of the Lumber River basin are from major municipal wastewater treatment plants. Nonmunicipal discharges also contribute

substantial wastewater flow into the Lumber River basin. Facilities, large or small, where recent data show problems with a discharge are listed and discussed in each subbasin chapter in Section B.

Table A-10 Summary of NPDES Dischargers and Permitted Flows for the Lumber River Basin (as of 11/27/02)

	Lumber River Subbasin										
Facility Categories	50	51	52	53	54	55	56	57	58	59	TOTAL
<b>Total Facilities</b>	4	14	3	5	0	11	2	4	6	3	52
Total Permitted Flow (MGD)	6.97	22.88	3.5	1.2	0.0	5.38	0.4	1.64	4.27	0.02	46.26
<b>Major Discharges</b>	1	7	2	0	0	1	0	1	2	0	14
Total Permitted Flow (MGD)	6.7	22.64	3.5	0.0	0.0	4.0	0.0	1.1	4.0	0.0	41.94
<b>Minor Discharges</b>	3	7	1	5	0	10	2	3	4	3	38
Total Permitted Flow (MGD)	0.27	0.24	0.0	1.2	0.0	1.38	0.4	0.54	0.27	0.02	4.32
<b>100% Domestic Waste</b>	0	1	0	0	0	2	0	3	0	1	7
Total Permitted Flow (MGD)	0.0	0.01	0.0	0.0	0.0	0.03	0.0	0.54	0.0	0.01	0.59
<b>Municipal Facilities</b>	1	4	2	3	0	4	1	1	3	0	19
Total Permitted Flow (MGD)	6.7	13.31	3.5	1.2	0.0	5.02	0.4	1.1	4.24	0.0	35.47
<b>Nonmunicipal Facilities</b>	3	10	1	2	0	7	1	3	3	3	33
Total Permitted Flow (MGD)	0.27	9.57	0.0	0.0	0.0	0.36	0.0	0.54	0.03	0.02	10.79

## 2.6.2 Other NPDES Permits

Stormwater permits are granted in the form of general permits (which cover a wide variety of more common activities) or individual permits. Excluding construction stormwater general permits, there are 122 general stormwater permits and four individual stormwater permits (see Appendix I for a listing). Refer to page 69 for more information on stormwater programs and permits.

## 2.7 Animal Operations

In 1992, the Environmental Management Commission adopted a rule modification (15A NCAC 2H.0217) establishing procedures for managing and reusing animal wastes from intensive livestock operations. The rule applies to new, expanding or existing feedlots with animal waste management systems designed to serve animal populations of at least the following size: 100 head of cattle, 75 horses, 250 swine, 1,000 sheep or 30,000 birds (chickens and turkeys) with a liquid waste system. Figure A-9 displays general locations of animal operations in the Lumber River basin.

### **Key Animal Operation Legislation (1995-2000)**

- 1995 Senate Bill 974 requires owners of swine facilities with 250 or more animals to hire a certified operator. Operators are required to attend a six-hour training course and pass an examination for certification. Senate Bill 1080 established buffer requirements for swine houses, lagoons and land application areas for farms sited after October 1, 1995.
- 1996 Senate Bill 1217 required all facilities (above threshold populations) to obtain coverage under a general permit, beginning in January 1997, for all new and expanding facilities. DWQ was directed to conduct annual inspections of all animal waste management facilities. Poultry facilities with 30,000+ birds and a liquid waste management system were required to hire a certified operator by January 1997 and facilities with dry litter animal waste management systems were required to develop an animal waste management plan by January 1998. The plan must address three specific items: 1) periodic testing of soils where waste is applied; 2) development of waste utilization plans; and 3) completion and maintenance of records on-site for three years. Additionally, anyone wishing to construct a new, or expand an existing, swine farm must notify all adjoining property owners.
- 1997 House Bill 515 placed a moratorium on new or existing swine farm operations and allows counties to adopt zoning ordinances for swine farms with a design capacity of 600,000 pounds (SSLW) or more. In addition, owners of potential new and expanding operations are required to notify the county (manager or chair of commission) and local health department, as well as adjoining landowners. NCDENR was required to develop and adopt economically feasible odor control standards by March 1, 1999.
- 1998 House Bill 1480 extended the moratorium on construction or expansion of swine farms. The bill also requires owners of swine operations to register with DWQ any contractual relationship with an integrator.
- 1999 House Bill 1160 extended (again) the moratorium on new construction or expansion of swine farms, required NCDENR to develop an inventory of inactive lagoons. The Bill requires owners/operators of an animal waste treatment system to notify the public in the event of a discharge to surface waters of the state of 1,000 gallons or more of untreated wastewater.
- 2000 Attorney General Easley reached a landmark agreement with Smithfield Foods, Inc. to phase out hog lagoons and implement new technologies that will substantially reduce pollutants from hog farms. The agreement commits Smithfield to phase out all anaerobic lagoon systems on 276 company-owned farms. Legislation will be required to phase out the remaining systems statewide within a 5-year period (State of Environment Report 2000).
- 2001 House Bill 1216 extended (again) the moratorium on new construction or expansion of swine farms.



**Figure A-9 Animal Operations in the Lumber River Basin**

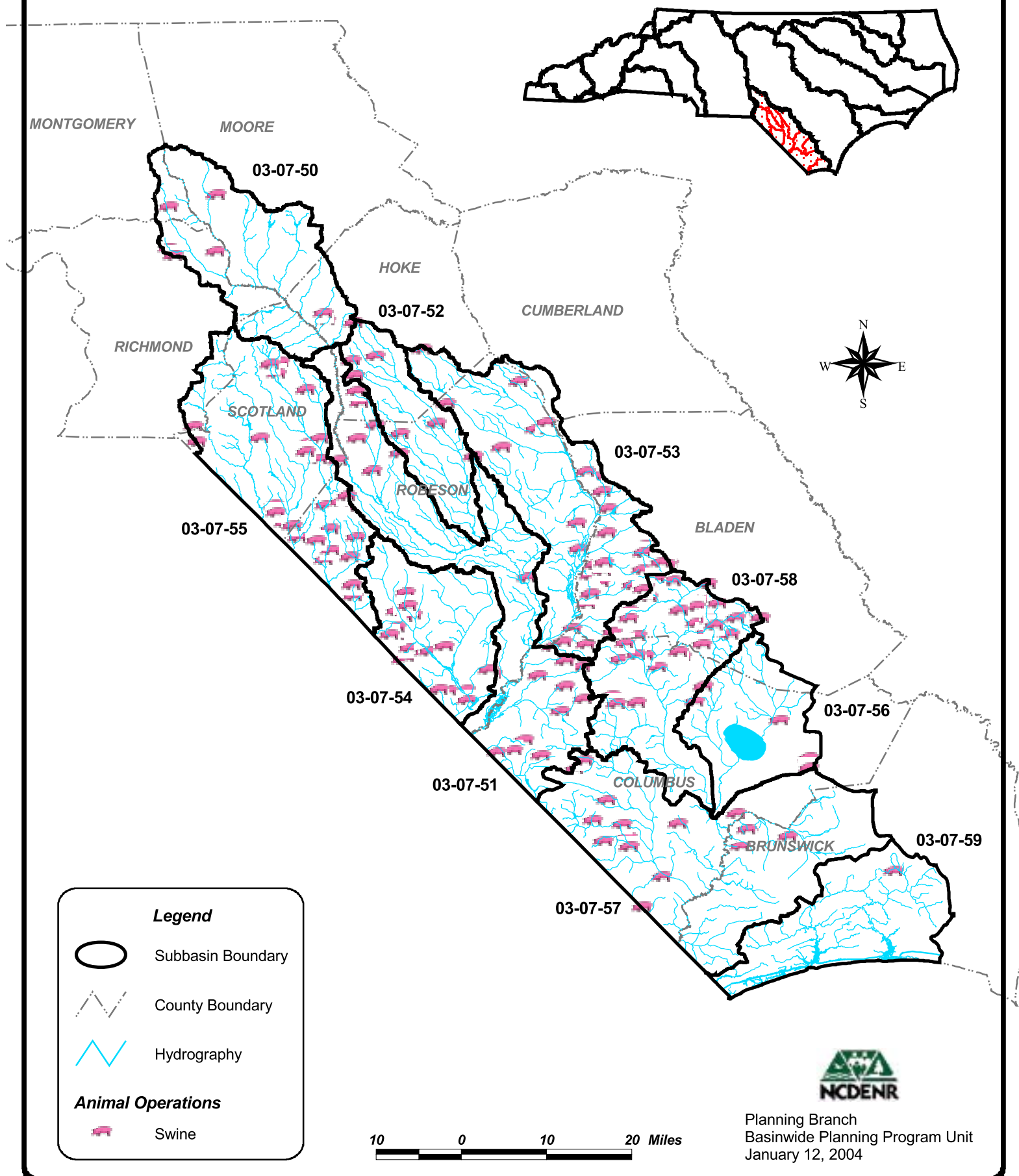


Table A-11 summarizes, by subbasin, the number of registered livestock operations, total number of animals, number of facilities, and total steady state live weight as of January 2003. These numbers reflect only operations required by law to be registered, and therefore, do not represent the total number of animals in each subbasin. There are no registered cattle or poultry operations in the Lumber River basin.

Overall the majority of registered swine operations are found in the middle portion of the basin. Registered animal operations where recent data show problems are discussed in the appropriate subbasin chapter in Section B.

Steady State Live Weight (SSLW) is the result, in pounds, after a conversion factor has been applied to the number (head count) of swine, cattle or poultry on a farm. The conversion factors, which come from the US Department of Agriculture (USDA), Natural Resource Conservation Service (NRCS) guidelines, vary depending on the type of animals on the farm and the type of operation (for example, there are five types of hog farms). Since the amount of waste produced varies by hog size, SSLW is the best way to compare the sizes of the farms.

Between 1994 and 1998, there were substantial increases in swine and poultry in the basin and a decrease in dairy operations. In several areas, animal density is much greater than human populations. Information on animal capacity by subbasin (Table A-12) was provided by the USDA.

Table A-11 Registered Swine Operations in the Lumber River Basin (as of 01/02/03)

Subbasin	Number of Facilities	Number of Animals	Total Steady State Live Weight
03-07-50	10	55,128	6,881,772
03-07-51	16	95,632	11,483,790
03-07-52	7	53,360	8,157,240
03-07-53	37	264,161	29,416,913
03-07-54	15	88,998	10,915,290
03-07-55	30	203,442	28,916,760
03-07-56	6	46,400	6,261,500
03-07-57	15	60,244	7,948,420
03-07-58	34	236,943	31,976,186
03-07-59	1	3,750	506,250
Totals	171	1,108,058	142,464,121

Table A-12 Estimated Populations of Swine, Dairy and Poultry in the Lumber River Basin (1998 and 1994)

Subbasin	Total Swine Capacity		Swine Change	Total Dairy Capacity		Dairy Change	Poultry Capacity		Poultry Change
	1998	1994	94-98 (%)	1998	1994	94-98 (%)	1998	1994	94-98 (%)
03-07-50	13,357	1,453	819	0	0	0	1,760,682	1,683,482	5
03-07-51	189,760	69,136	174	55	15	267	1,391,000	710,600	96
03-07-52	43,475	32,200	35	2	0	2	363,300	182,900	99
03-07-53	203,688	97,169	110	0	4	-100	1,972,650	1,409,350	40
03-07-54	112,060	30,983	262	0	0	0	1,362,000	738,200	85
03-07-55	181,153	121,675	49	0	0	0	3,602,500	2,888,500	25
03-07-56	4,394	6,168	-29	0	0	0	0	0	0
03-07-57	92,833	40,563	129	0	775	-100	0	0	0
03-07-58	238,516	83,636	185	0	120	-100	50,300	50,300	0
03-07-59	10,709	7,542	42	0	0	0	0	0	0
TOTALS	1,089,945	490,525	122	57	914	-94	10,502,432	7,663,332	37
% of State Total	11%	9%		<1%	<1%		5%	4%	

## 2.8 Permitted Wetland and Stream Losses and Mitigation

DWQ tracks wetland and stream losses that are authorized through the issuance of a 401 Water Quality Certification. In addition to the permitted wetland and stream impacts that are tracked by DWQ, an unknown amount of wetland and stream losses also occurs because projects that affect less than one-third of an acre of wetland or less than 150 linear feet of stream are not required to receive written confirmation from DWQ, and therefore, might not be reported. The magnitude of unauthorized impacts to wetlands and streams is not known.

## 2.9 Natural Resources

### 2.9.1 Ecological Significance of the Lumber River Basin

The Lumber River basin encompasses three distinct ecological regions in North Carolina: the Sandhills, the Carolina Bay region and the Southeastern Coastal Plain. This assemblage of ecological regions gives the Lumber River basin a great diversity of natural communities. From the vast pocosins of the Green Swamp to the large Carolina bay that became Lake Waccamaw to the dry sandy hills cloaked with magnificent longleaf pines, the Lumber River basin is a showcase of biological diversity. Of particular note in the Lumber River basin are wetland communities associated with the blackwater river floodplains and pine savannas. Table A-13 presents rare aquatic and wetland-dwelling species found in the Lumber River basin.

Table A-13 Rare Aquatic and Wetland-Dwelling Species in the Lumber River Basin (as of March 2003)

Major Taxon	Scientific Name	Common Name	State Status	Federal Status
Amphibian	<i>Ambystoma tigrinum</i>	Eastern tiger salamander	T	
Amphibian	<i>Rana heckscheri</i>	River frog	SC	
Amphibian	<i>Eurycea quadridigitata pop 1</i>	Dwarf salamander - silver morph	SC	
Amphibian	<i>Ambystoma mabeei</i>	Mabee's salamander	SR	
Amphibian	<i>Pseudacris ornata</i>	Ornate chorus frog	SR	
Amphibian	<i>Rana capito</i>	Carolina gopher frog	T	FSC
Amphibian	<i>Hyla andersonii</i>	Pine barrens treefrog	SR	
Crustacean	<i>Procambarus braswelli</i>	Waccamaw crayfish	SC	
Fish	<i>Noturus sp 1</i>	Broadtail madtom	SC	
Fish	<i>Menidia extensa</i>	Waccamaw silverside	T	T
Fish	<i>Elassoma boehlkei</i>	Carolina pygmy sunfish	T	FSC
Fish	<i>Semotilus lumbee</i>	Sandhills chub	SC	
Fish	<i>Gobionellus stigmaticus</i>	Marked goby	SR	
Fish	<i>Hypsoblennius ionthas</i>	Freckled blenny	SR	
Fish	<i>Cyprinella zanema pop 2</i>	Santee chub - Coastal Plain population	SC	
Fish	<i>Etheostoma perlongum</i>	Waccamaw darter	T	
Fish	<i>Fundulus waccamensis pop 1</i>	Waccamaw killifish - Lake Waccamaw population	SC	FSC
Fish	<i>Etheostoma mariae</i>	Pinewoods darter	SC	FSC
Insect	<i>Euphyes bimacula</i>	Two-spotted skipper	SR	
Insect	<i>Calephelis virginienensis</i>	Little metalmark	SR	
Insect	<i>Callophrys hesseli</i>	Hessel's hairstreak	SR	
Insect	<i>Amblyscirtes reversa</i>	Reversed roadside-skipper	SR	
Insect	<i>Attaneuria ruralis</i>	A stonefly	SR	
Insect	<i>Trienodes marginata</i>	A caddisfly	SR	
Insect	<i>Choroterpes basalis</i>	A mayfly	SR	
Insect	<i>Ceraclea cancellata</i>	A caddisfly	SR	
Insect	<i>Ephemerella argo</i>	A mayfly	SR	FSC
Mammal	<i>Trichechus manatus</i>	West Indian manatee	E	E
Mollusk	<i>Cincinnatia sp 1</i>	Waccamaw siltsnail	SC	
Mollusk	<i>Lampsilis cariosa</i>	Yellow lampmussel	E	FSC
Mollusk	<i>Elliptio folliculata</i>	Pod lance	SC	

Mollusk	<i>Lampsilis radiata radiata</i>	Eastern lampmussel	T	
Mollusk	<i>Leptodea ochracea</i>	Tidewater mucket	T	
Mollusk	<i>Amnicola sp 1</i>	Waccamaw snail	SC	
Mollusk	<i>Elliptio marsupiobesa</i>	Cape Fear spike	SC	
Mollusk	<i>Elliptio waccamawensis</i>	Waccamaw spike	T	FSC
Mollusk	<i>Lampsilis fullerkati</i>	Waccamaw fatmucket	T	FSC
Mollusk	<i>Viviparus intertextus</i>	Rotund mysterysnail	SR	
Mollusk	<i>Triodopsis soelneri</i>	Cape Fear threetooth	T	FSC
Mollusk	<i>Toxolasma pullus</i>	Savannah lilliput	E	FSC
Reptile	<i>Caretta caretta</i>	Loggerhead	T	T
Reptile	<i>Seminatrix pygaea</i>	Black Swamp snake	SR	
Reptile	<i>Regina rigida</i>	Glossy crayfish snake	SR	
Reptile	<i>Deirochelys reticularia</i>	Chicken turtle	SR	
Reptile	<i>Alligator mississippiensis</i>	American alligator	T	T(S/A)

#### Rare Species Listing Criteria

- E = Endangered (those species in danger of becoming extinct)  
T = Threatened (considered likely to become endangered within the foreseeable future)  
SR = Significantly Rare (rare in North Carolina, but not yet officially listed as threatened or endangered)  
SC = Special Concern (have limited numbers in North Carolina and vulnerable populations in need of monitoring)  
FSC = Federal Species of Concern (those under consideration for listing under the Federal Endangered Species Act)

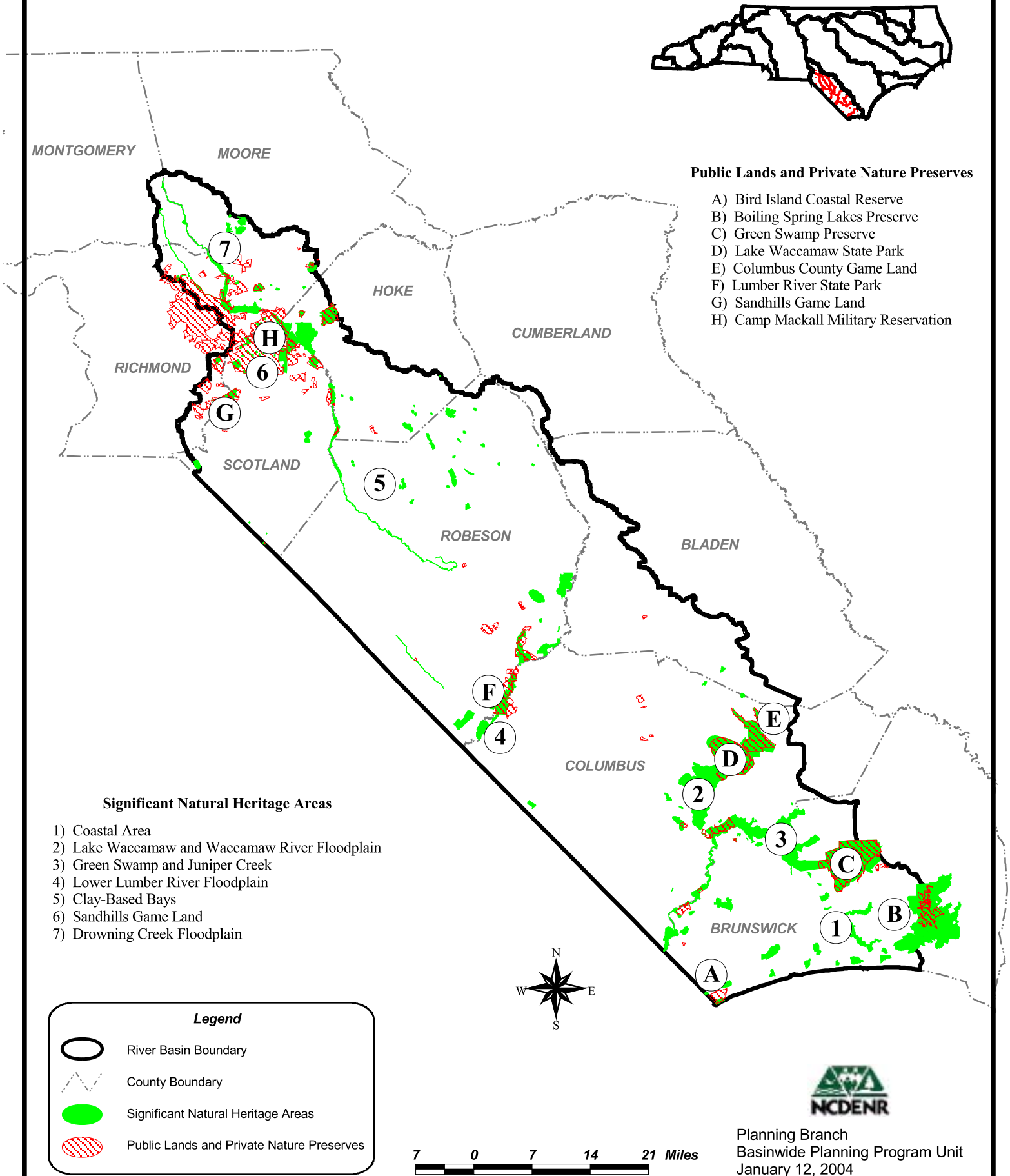
## 2.9.2 Significant Natural Heritage Areas in the Lumber River Basin

The North Carolina Natural Heritage Program identifies areas that have outstanding conservation value, either because they contain rare or endangered species, or because an area provides an excellent, intact example of an ecological community which naturally occurs in the state. The Lumber River basin contains more than 150 individual significant natural heritage areas (aquatic and terrestrial). It is beyond the scope of this report to discuss even a large fraction of these areas; however, some of the more impressive aquatic areas are mentioned. Refer to Figure A-10 for more information.

### Lumber River Watershed

The Lumber River is one of the largest blackwater rivers in the state and it contains notable wetland communities and high quality floodplain forests. These floodplain forests act as buffers, preserving the water quality of the Lumber River. Consequently, the river continues to maintain populations of rare animal species, including fishes such as the pinewoods darter, broadtail madtom and the sandhills chub. In addition, Drowning Creek, Naked Creek, Ashpole Swamp and Bear Swamp contain significant fish, mollusk and insect species.

**Figure A-10 Lumber River Basin Managed Lands and Significant Heritage Areas**



## **Little Pee Dee Watershed**

The significant wetland communities of this watershed consist of Sandhill Seeps, Streamhead Pocosins, Coastal Plain Small Stream Swamps, and Streamhead Atlantic White Cedar Forests. Although less extensive than wetlands in other areas, wetland and aquatic communities in the Sandhills harbor rare plants and animals, including rare fish, amphibians and plants. The most significant natural areas in this watershed are uplands, especially the dry longleaf pine communities of the Sandhills Game Land.

## **Waccamaw River Watershed**

Encompassing the Green Swamp, Lake Waccamaw and the Waccamaw River, this watershed is characterized by biological richness. Much of its outstanding diversity is due to the extensive wetlands which include High Pocosins, Pine Savannas, Oxbow Lakes, Sand and Mud Bars, and Wet Pine Flatwoods to name a few. Lake Waccamaw is nationally significant and contains a number of endemic and near-endemic species, rare species, and natural communities. The most significant natural areas in the Waccamaw River watershed form corridors along major waterbodies, connecting Friar Swamp and Lake Waccamaw to the Green Swamp via Juniper Creek and connecting all of these areas to a rich South Carolina estuary via the Waccamaw River. In itself, the connectivity of these high quality natural places is an important ecological feature which lends national significance to these already unique and biologically diverse sites.

L.B. Cahoon et al. conducted research on the unique, natural limestone formation and its effects on productivity in Lake Waccamaw (Cahoon et al., 1993).

## **Coastal Area Watershed**

The Coastal watershed includes the barrier islands and peninsulas off southeastern North Carolina, along with a sizeable portion of inland Brunswick County including the Lockwoods Folly River. The wetland communities of inland Brunswick County are diverse and include many high quality nonriverine communities. High quality marshes and tidal wetlands line the edges of the mainland and barrier islands. The barrier islands are home to a number of rare species such as the federally threatened loggerhead turtle. Boiling Spring Lakes Wetland Complex is a nonriverine wetland assemblage which lies on the border of two watersheds. The natural area is punctuated by long, low ridges of sand, remnants of ancient dunes, interspersed with swales containing shallow peat. Deeper peat fills the large Carolina bays scattered throughout. The site is the largest hydrologically intact wetland complex in Brunswick County and one of the largest in the Coastal Plain.

### **2.9.3 Conservation Lands**

There are a number of state-owned lands within the Lumber River basin. The Division of Parks and Recreation's lands include the Lake Waccamaw State Park, Lumber River State Park and Weymouth Woods State Natural Area (which lies in two watersheds). The Wildlife Resources Commission owns and manages Sandhills Game Land, Bullard and Branch Hunting Preserve, and Columbus County Game Land. The Division of Coastal Management manages the Bird Island Coastal Reserve. The Department of Transportation owns over 1,000 acres of mitigation

sites -- sites which are permanently protected. The Department of Agriculture is protecting the Boiling Spring Lakes Wetland Complex and already owns over 3,000 acres of this ecologically rich landscape.

The contribution of private organizations to conservation in the Lumber River basin has been invaluable. The Nature Conservancy owns and manages a number of nationally significant nature preserves, from small pine savanna and clay-based Carolina bay preserves to the over 16,000-acre Green Swamp Preserve. The Lumber River Conservancy and other local land trusts have also been working to protect the landscape of the Lumber River basin from further fragmentation, benefiting wildlife and improving the quality of life for residents. The Lumber River Conservancy has acquired a total of 1,966 acres on the Lumber River and its tributaries by transferring 566 acres to the Lumber River State Park and 43 acres to the NC Wildlife Resource Commission. In addition, the Lumber River Conservancy continues to hold in fee 1,355.2 acres along the Lumber River and its tributaries and holds a conservation easement of 486 acres along Raft Swamp.

#### **2.9.4 Fisheries**

From 2000 through 2003, the NC Wildlife Resources Commission (NCWRC) sampled the resident fish community of the Lumber River mainstem at three sites using standard boat-mounted electrofishing gear. The sampling locations were at Fair Bluff, the State Park at Princess Ann, and behind Ed's Tire store in downtown Lumberton. The Fair Bluff and Princess Ann sites were sampled once each in late summer from 2000 through 2002 (6 total samples). The Ed's Tire site was sampled once, in August 2003. The number of species collected at these sites ranged from 14-20 with a mean of 18 species. Freshwater fish species of recreational importance found in the Lumber River included largemouth bass, bluegill, redear sunfish, redbreast sunfish, pumpkinseed, warmouth, dollar sunfish, spotted sunfish, channel catfish, white catfish, chain pickerel, redbfin pickerel, and yellow perch. All of the species mentioned above, except catfish, are classified as inland game fish by the NCWRC. Nongame species commonly encountered included American eel, bowfin, common carp, longnose gar, creek chubsucker, gizzard shad, spotted sucker, golden shiner, ironcolor shiner, coastal shiner, dusky shiner, satinfofin shiner, brook silverside, and tessellated darter.

Largemouth bass support popular fisheries year-round throughout the river; however, peak fishing is in late spring and early summer. The Lumber River mainstem provides excellent fishing for redbreast sunfish from Wagram to Boardman as does the Big Swamp, a major tributary to the Lumber River. The Big Swamp is a popular blackwater stream providing good fishing for chain and redbfin pickerel, redbreast sunfish, bluegill and largemouth bass. The Big Swamp is managed under the WRC's Black Bass Management Plan (NCWRC, 1993) and all statewide fishing regulations apply.

Anadromous species found within the lower reaches of the Lumber River basin (lower Little Pee Dee River in South Carolina) include striped bass, American shad, hickory shad, blueback herring and alewife (Dan Crochet, SCDNR, pers. comm.). Blueback herring and alewife are generally considered collectively as river herring. Anadromous fish typically spend their adult lives in saltwater environments and migrate inland into the mainstem of the Great Pee Dee River



and the lower end of the Little Pee Dee River and its tributaries to spawn. Abundance of these anadromous species is low in the upper reaches of the Lumber River in North Carolina.

## **2.9.5 Forestry in the Lumber River Basin**

### ***Forest Resources***

Nearly two-thirds of the forestland in the Lumber River basin are owned by nonindustrial private landowners, with most of the remaining one-third owned by forest industry. Less than four percent of forestland in the basin is in public ownership. For comparison, statewide figures show that over three-quarters of the forestland are owned by nonindustrial private landowners, while only 13 percent of forestland is owned by forest industry. All data are from the most recent study by the USDA-Forest Service in 1990 (USDA-North Carolina's Forests, 1990, Southeastern Forest Experiment Stn Resource Bulletin SE-142).

For the period of January 1998 through December 2002, nearly 39,000 acres of private land in the Lumber River basin were recorded as having been regenerated in trees, with 70 percent of these acres utilizing cost shared funding through various state or federal programs. Figures for tree regeneration on forest industry land were not available.

From the most recent data available, only nine businesses in the basin are considered as "Primary Processors" of forestry-related raw material, which represents just 3 percent of the total number in North Carolina. A primary processor may include a sawmill, veneer, chip or paper mill. Forest management is an important land use in the basin despite the low number of actual processing plants, as evidenced by the higher proportion of land owned by the forest industry within the basin, when compared to the rest of the state.

### ***Forestry Regulation in North Carolina***

Forestry operations in North Carolina are subject to regulation under the Sedimentation Pollution Control Act of 1973 (G.S. Chapter 113A, Article 4 referred to as "SPCA"). However, forestry operations may be exempt from the permit requirements in the SPCA, if the operations meet compliance standards outlined in the *Forest Practices Guidelines Related to Water Quality* (15A NCAC 11 .0101 - .0209, referred to as "FPGs") and General Statutes regarding stream obstruction (G.S. 77-13 and G.S. 77-14). Detailed information is available on the Water Quality Section of the DFR's website at [www.dfr.state.nc.us](http://www.dfr.state.nc.us).

The North Carolina Division of Forest Resources (DFR) is delegated the authority, by the Division of Land Resources, to monitor and evaluate forestry operations for compliance with these laws. In addition, the DFR works to resolve identified FPG compliance questions brought to its attention. Violations of the FPG performance standards that cannot be resolved by the DFR are referred to the Division of Land Resources for enforcement action. From 1998 through 2002, the DFR conducted 1,501 FPG inspections of forestry and/or timber harvesting activities in the Lumber River basin; 97 percent of the sites inspected were in compliance.

The lower portion of the Lumber River basin falls within the coverage area for one of the DFR's Water Quality Foresters, based in the Whiteville District office. The DFR has a Water Quality Forester assigned in seven of the DFR's 13 districts across the state. The Water Quality Foresters conduct FPG inspections, develop pre-harvest plans, and provide training opportunities

for landowners, loggers and the public regarding water quality issues related to forestry. Service Foresters and/or County Rangers handle water quality issues in the remainder of the basin, along with their other forest management and fire control responsibilities. Contact information for each district and/or county can be found on the DFR's website at [www.dfr.state.nc.us](http://www.dfr.state.nc.us).

#### *Forestry Best Management Practices*

The implementation of Forestry Best Management Practices (BMPs) is encouraged by the DFR in order to protect the water resources of North Carolina. The *Forestry Best Management Practices Manual* describes recommended techniques that may be used to comply with the state's forestry laws. The BMP Manual is being revised; publication of the new edition is expected during 2004. The new version of the manual will be printed in a pocket-sized version and a full-sized desktop version. The smaller sized, condensed version will allow for greater distribution and on-site use by loggers and equipment operators.

Among the BMPs promoted for timber harvesting is the use of bridgemats for establishing temporary stream crossings. Currently, in the Lumber River basin, the DFR provides bridgemats for short-term loan to loggers for use in all counties located in the basin. The DFR's Bridgemat Loan and Education Program is an educational and protection project which promotes the benefits of using portable bridges for stream crossings, in lieu of using other techniques such as culverts or hard-surface crossings; both of which have a greater potential to result in sedimentation. All bridgemat purchases for the DFR's Program are funded by grant awards from the USEPA's Nonpoint Source Pollution Management Program.

## Section A - Chapter 3

### Summary of Water Quality Information for the Lumber River Basin

#### 3.1 General Sources of Pollution

Human activities can negatively impact surface water quality, even when the activity is far removed from the waterbody. With proper management of wastes and land use activities, these impacts can be minimized. Pollutants that enter waters fall into two general categories: *point sources* and *nonpoint sources*.

##### **Point Sources**

Piped discharges from:

- Municipal wastewater treatment plants
- Industrial facilities
- Small package treatment plants
- Large urban and industrial stormwater systems

Point sources are typically piped discharges and are controlled through regulatory programs administered by the state. All regulated point source discharges in North Carolina must apply for and obtain a National Pollutant Discharge Elimination System (NPDES) (see page 22) permit from the state.

Nonpoint sources are from a broad range of land use activities. Nonpoint source pollutants are typically carried to waters by rainfall, runoff or snowmelt. Sediment (see page 62) and nutrients

##### **Nonpoint Sources**

- Construction activities
- Roads, parking lots and rooftops
- Agriculture
- Failing septic systems and straight pipes
- Timber harvesting
- Hydrologic modifications

(see page 76) are most often associated with nonpoint source pollution. Other pollutants associated with nonpoint source pollution include fecal coliform bacteria (see page 66), heavy metals, oil and grease, and any other substance that may be washed off the ground or deposited from the atmosphere into surface waters.

Unlike point source pollution, nonpoint pollution sources are diffuse in nature and occur

intermittently, depending on rainfall events and land disturbance. Given these characteristics, it is difficult and resource intensive to quantify nonpoint contributions to water quality degradation in a given watershed. While nonpoint source pollution control often relies on voluntary actions, the state has many programs designed to reduce nonpoint source pollution.

Every person living in or visiting a watershed contributes to impacts on water quality. Therefore, each individual should be aware of these contributions and take actions to reduce them.

##### **Cumulative Effects**

While any one activity may not have a dramatic effect on water quality, the cumulative effect of land use activities in a watershed can have a severe and long-lasting impact.

## 3.2 Description of Surface Water Classifications and Standards

North Carolina's Water Quality Standards Program adopted classifications and water quality standards for all the state's river basins by 1963. The program remains consistent with the Federal Clean Water Act and its amendments. Water quality classifications and standards have also been modified to promote protection of surface water supply watersheds, high quality waters, and the protection of unique and special pristine waters with outstanding resource values.

### Statewide Classifications

All surface waters in the state are assigned a *primary* classification that is appropriate to the best uses of that water. In addition to primary classifications, surface waters may be assigned a *supplemental* classification. Most supplemental classifications have been developed to provide special protection to sensitive or highly valued resource waters. Table A-14 briefly describes the best uses of each classification. A full description is available in the document titled: *Classifications and Water Quality Standards Applicable to Surface Waters and Wetlands of North Carolina, 2000*. Information on this subject is also available at DWQ's website: <http://h2o.enr.state.nc.us/wqhome.html>.

Table A-14 Primary and Supplemental Surface Water Classifications

PRIMARY FRESHWATER AND SALTWATER CLASSIFICATIONS*	
<u>Class</u>	<u>Best Uses</u>
<b>C and SC</b>	Aquatic life propagation/protection and secondary recreation.
<b>B and SB</b>	Primary recreation and Class C uses.
<b>SA</b>	Waters classified for commercial shellfish harvesting.
<b>WS</b>	<i>Water Supply watershed</i> . There are five WS classes ranging from WS-I through WS-V. WS classifications are assigned to watersheds based on land use characteristics of the area. Each water supply classification has a set of management strategies to protect the surface water supply. WS-I provides the highest level of protection and WS-IV provides the least protection. A Critical Area (CA) designation is also listed for watershed areas within a half-mile and draining to the water supply intake or reservoir where an intake is located.
SUPPLEMENTAL CLASSIFICATIONS	
<u>Class</u>	<u>Best Uses</u>
<b>Sw</b>	<i>Swamp Waters</i> : Recognizes waters that will naturally be more acidic (have lower pH values) and have lower levels of dissolved oxygen.
<b>Tr</b>	<i>Trout Waters</i> : Provides protection to freshwaters for natural trout propagation and survival of stocked trout.
<b>HQW</b>	<i>High Quality Waters</i> : Waters possessing special qualities including excellent water quality, Native or Special Native Trout Waters, Critical Habitat areas, or WS-I and WS-II water supplies.
<b>ORW</b>	<i>Outstanding Resource Waters</i> : Unique and special surface waters which are unimpacted by pollution and have some outstanding resource values.
<b>NSW</b>	<i>Nutrient Sensitive Waters</i> : Areas with water quality problems associated with excessive plant growth resulting from nutrient enrichment.

\* Primary classifications beginning with a "S" are assigned to saltwaters.

## **Statewide Water Quality Standards**

Each primary and supplemental classification is assigned a set of water quality *standards* that establish the level of water quality that must be maintained in the waterbody to support the uses associated with each classification. Some of the standards, particularly for HQW and ORW waters, outline protective management strategies aimed at controlling point and nonpoint source pollution. These strategies are discussed briefly below. The standards for C and SC waters establish the basic protection level for all state surface waters. The other primary and supplemental classifications have more stringent standards than for C and SC, and therefore, require higher levels of protection.

Some of North Carolina's surface waters are relatively unaffected by pollution sources and have water quality higher than the standards that are applied to the majority of the waters of the state. In addition, some waters provide habitat for sensitive biota such as trout, juvenile fish, or rare and endangered aquatic species.

### **High Quality Waters**

There are 140.6 stream miles and 21.0 estuarine acres of HQW waters (Figure A-11) throughout the Lumber River basin. Special HQW protection management strategies are intended to prevent degradation of water quality below present levels from both point and nonpoint sources. HQW requirements for new wastewater discharge facilities and facilities which expand beyond their currently permitted loadings address oxygen-consuming wastes, total suspended solids, disinfection, emergency requirements, volume, nutrients (in nutrient sensitive waters) and toxic substances.

#### **Criteria for HQW Classification**

- Waters rated as Excellent based on DWQ's chemical and biological sampling.
- Streams designated as native or special native trout waters by the Wildlife Resources Commission.
- Waters designated as primary nursery areas or other functional nursery areas by the Division of Marine Fisheries.
- Waters classified by DWQ as WS-I, WS-II or SA.

For nonpoint source pollution, development activities which require a Sedimentation and Erosion Control Plan in accordance with rules established by the NC Sedimentation Control Commission or an approved local erosion and sedimentation control program, and which drain to and are within one mile of HQWs, are required to control runoff from the development using either a low density or high density option. The low density option requires a 30-foot vegetated buffer between development activities and the stream; whereas, the high density option requires structural stormwater controls. In addition, the Division of Land Resources requires more stringent erosion controls for land-disturbing projects within one mile of and draining to HQWs.

### **Outstanding Resource Waters**

There are 20.0 stream miles and 8,840.2 freshwater acres of ORW waters (Figure A-11) in the Lumber River basin. These waters have excellent water quality (rated based on biological and chemical sampling as with HQWs) and an associated outstanding resource.

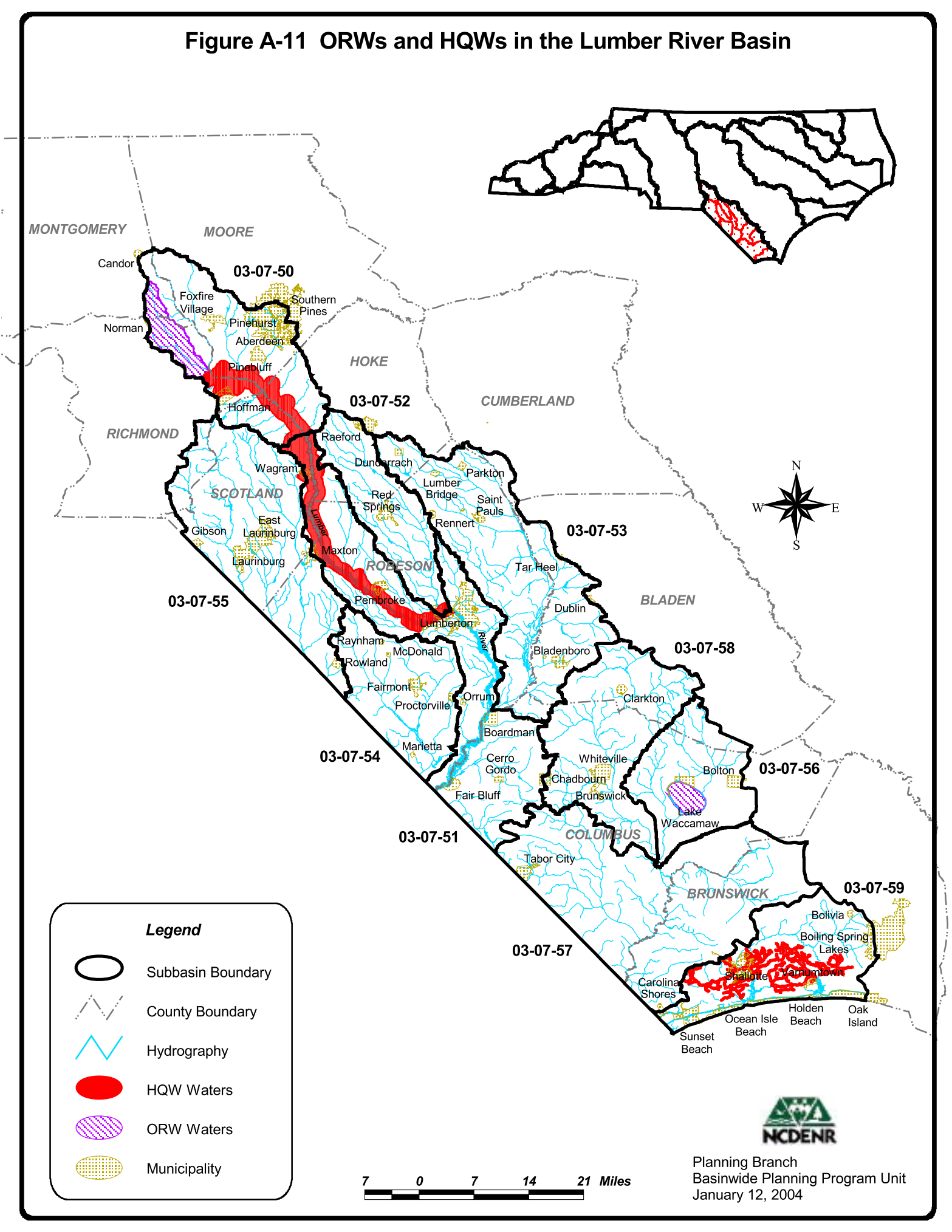
### Figure A-11 ORWs and HQWs in the Lumber River Basin

**Legend**

- Subbasin Boundary
- County Boundary
- Hydrography
- HQW Waters
- ORW Waters
- Municipality

7 0 7 14 21 Miles

Planning Branch  
Basinwide Planning Program Unit  
January 12, 2004





***The ORW rule defines outstanding resource values as including one or more of the following:***

- an outstanding fisheries resource;
- a high level of water-based recreation;
- a special designation such as National Wild and Scenic River or a National Wildlife Refuge;
- within a state or national park or forest; or
- a special ecological or scientific significance.

The requirements for ORW waters are more stringent than those for HQWs. Special protection measures that apply to North Carolina ORWs are set forth in 15A NCAC 2B .0225. At a minimum, no new discharges or expansions are permitted, and a 30-foot vegetated buffer or stormwater controls for new developments are required. In some circumstances, the unique characteristics of the waters and resources

that are to be protected require that a specialized (or customized) ORW management strategy be developed.

### **Primary Recreation (Class B and SB)**

There are 135.6 stream miles, 115.0 freshwater acres and 25.6 miles of Atlantic coastline classified for primary recreation in the Lumber River basin. Primary recreation is also a classified use of shellfish harvesting (Class SA) waters.

### **Water Supply Watersheds**

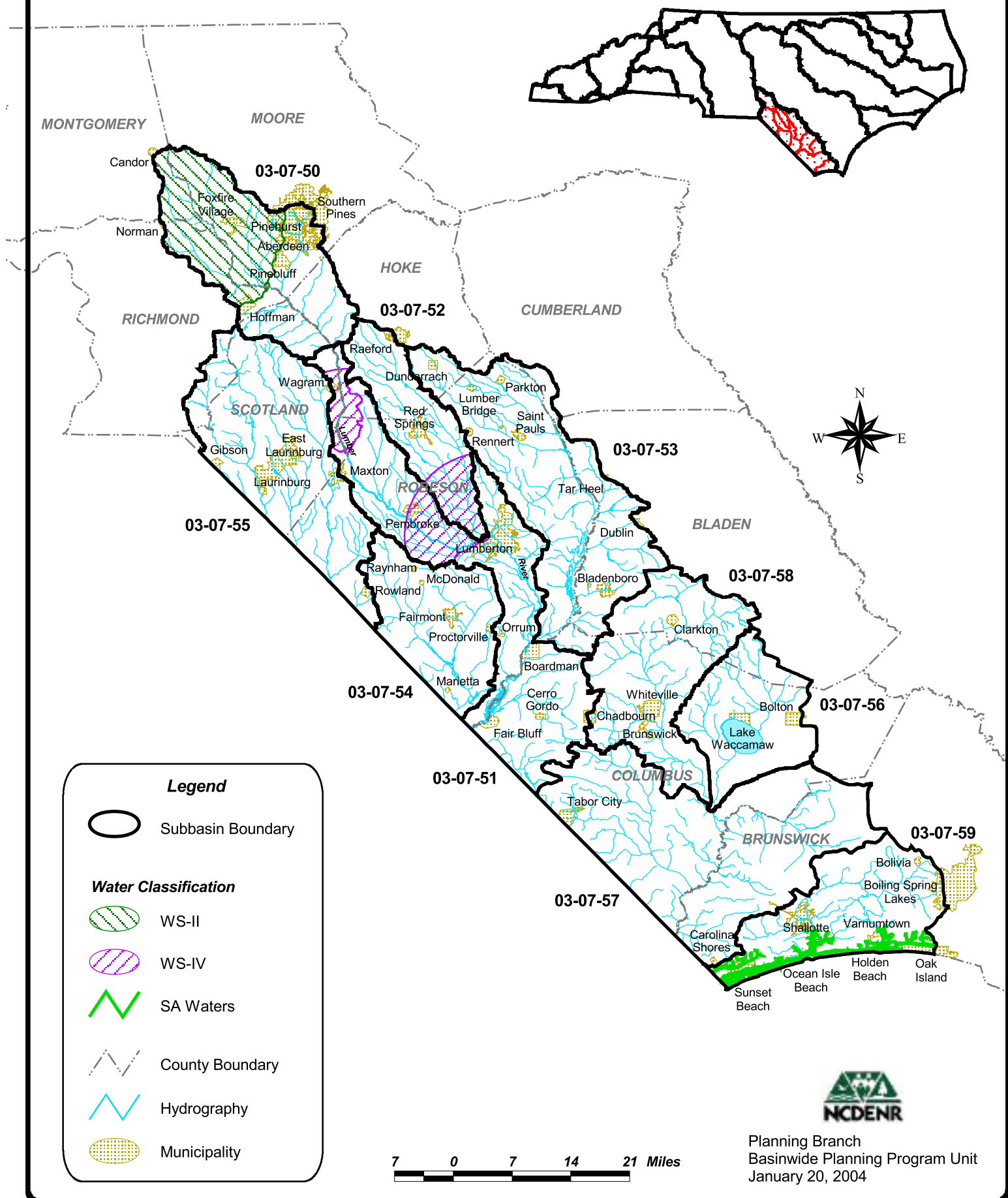
There are 216.7 stream miles classified as water supply watersheds in the Lumber River basin (Figure A-12). The purpose of the Water Supply Watershed Protection Program is to provide a proactive drinking water supply protection program for communities. Local governments administer the program based on state minimum requirements. There are restrictions on wastewater discharges, development, landfills and residual application sites to control the impacts of point and nonpoint sources of pollution.

There are five water supply classifications (WS-I to WS-V) that are defined according to the land use characteristics of the watershed. The WS-I classification carries the greatest protection for water supplies. No development is allowed in these watersheds. Generally, WS-I lands are publicly owned. WS-V watersheds have the least amount of protection and do not require development restrictions. These are either former water supply sources or sources used by industry. WS-I and WS-II classifications are also HQW by definition because requirements for these levels of water supply protection are at least as stringent as those for HQWs. Those watersheds classified as WS-II through WS-IV require local governments having jurisdiction within the watersheds to adopt and implement land use ordinances for development that are at least as stringent as the state's minimum requirements. A 30-foot vegetated setback is required on perennial streams in these watersheds.

### **Shellfish Harvesting**

There are 4,280.8 acres of estuarine waters classified for shellfish harvesting (Figure A-12) in the Lumber River basin. The best uses of Class SA waters are for shellfishing for market purposes and any other usage specified by the "SB" or "SC" classification. Fecal coliform bacteria (see page 66) in Class SA waters shall meet the current sanitary and bacteriological standards as

**Figure A-12 Water Supply Watersheds and Class SA Waters in the Lumber River Basin**





adopted by the Commission for Health Services. Domestic wastewater discharges are not allowed, and there are provisions for stormwater controls. Refer to 15A NCAC 2B .0221 for specifics on water quality standards in Class SA waters.

### **Pending and Recent Reclassifications in the Lumber River Basin**

In 2000, by request from the Division of Water Resources and the Office of Conservation and Community Affairs' Natural Heritage Program, Lake Waccamaw (Columbus County) was designated as ORW (Outstanding Resource Water).

## **3.3 DWQ Water Quality Monitoring Programs in the Lumber River Basin**

Staff in the Environmental Sciences Branch and Regional Offices of DWQ collect a variety of biological, chemical and physical data. The following discussion contains a brief introduction to each program, followed by a summary of water quality data in the Lumber River basin for that program. For more detailed information on sampling and assessment of streams in this basin, refer to the *Basinwide Assessment Report* for the Lumber River basin, available from the Environmental Sciences Branch website at <http://www.esb.enr.state.nc.us/bar.html> or by calling (919) 733-9960.

### ***DWQ monitoring programs for the Lumber River Basin include:***

- Benthic Macroinvertebrates (Section 3.3.1)
- Fish Assessments (Section 3.3.2)
- Aquatic Toxicity Monitoring (Section 3.3.3)
- Lake Assessment (Section 3.3.4)
- Ambient Monitoring System (Section 3.3.5)

### **3.3.1 Benthic Macroinvertebrate Monitoring**

Benthic macroinvertebrates, or benthos, are organisms that live in and on the bottom substrates of rivers and streams. These organisms are primarily aquatic insect larvae. The use of benthos data has proven to be a reliable monitoring tool, as benthic macroinvertebrates are sensitive to subtle changes in water quality. Since macroinvertebrates have life cycles of six months to over one year, the effects of short-term pollution (such as a spill) will generally not be overcome until the following generation appears. The benthic community also integrates the effects of a wide array of potential pollutant mixtures.

Criteria have been developed to assign a bioclassification to each benthic sample based on the number of different species present in the pollution intolerant groups of Ephemeroptera (Mayflies), Plecoptera (Stoneflies) and Trichoptera (Caddisflies), commonly referred to as EPTs; and a Biotic Index value, which gives an indication of overall community pollution tolerance. Different benthic macroinvertebrate criteria have been developed for different ecoregions (mountains, piedmont and coastal plain) within North Carolina. Bioclassifications fall into five categories ranging from Poor to Excellent.

Extensive evaluation of swamp streams across eastern North Carolina suggests that current coastal plain criteria are not appropriate for assessing the condition of water quality in these

special systems. Swamp streams are characterized by slower flow, lower dissolved oxygen, lower pH, dark-colored water and sometimes very complex braided channels that may cease flowing during summer low flow periods. This seasonal interruption in flow limits the diversity of the fauna, requiring special criteria to properly rate such streams. As of December 2002, DWQ finalized and approved a multi-metric system to refine biological criteria to assign bioclassifications to these streams. However, the criteria were not finalized during the biological assessment of the Lumber River basin (1996-2001). Refer to page 57 for more detailed information.

### **Overview of Benthic Macroinvertebrate Data**

Appendix II lists all the benthic macroinvertebrate collections in the Lumber River basin between 1983 and 2001, giving site location, collection date, taxa richness, biotic index values and bioclassifications. There were 40 benthic samples collected during this assessment period. Table A-15 lists the most recent bioclassifications (by subbasin) for all benthos sites in the Lumber River basin. Most of the streams listed as "Not Rated" are characterized as swamp streams, page 57. Streams listed as "Good" or "Excellent" are generally found in the Sandhills region, in the upper reaches of the Lumber River, and in the Waccamaw River. A designation of Not Impaired may be used for flowing waters that are too small to be assigned a bioclassification (less than four meters in width), but meet the criteria for a Good-Fair or higher bioclassification using the standard qualitative and EPT criteria. Refer to page 58 for more information.

Table A-15 Summary of Bioclassifications for All Freshwater Benthic Macroinvertebrate Sites (using the most recent rating for each site) in the Lumber River Basin

Subbasin	Excellent	Good	Good-Fair	Fair	Poor	Not Impaired	Not Rated	Total
03-07-50	2	2	0	0	0	0	2	6
03-07-51	5	0	1	0	0	1	4	11
03-07-52	0	0	0	0	0	0	3	3
03-07-53	0	0	0	0	0	0	2	2
03-07-54	0	0	0	0	0	0	2	2
03-07-55	0	3	1	0	0	0	0	4
03-07-56	0	1	0	0	0	0	2	3
03-07-57	0	2	0	0	0	0	2	4
03-07-58	0	0	0	0	0	0	2	2
03-07-59	0	0	1	0	0	0	2	3
<b>Total (#)</b>	<b>7</b>	<b>8</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>21</b>	<b>40</b>
<b>Total (%)</b>	<b>17.5</b>	<b>20</b>	<b>7.5</b>	<b>0</b>	<b>0</b>	<b>2.5</b>	<b>52.5</b>	<b>100</b>

### **3.3.2 Fish Assessments**

Scores are assigned to fish community samples using the North Carolina Index of Biotic Integrity (NCIBI). The NCIBI uses a cumulative assessment of 12 parameters or metrics. Each metric is designed to contribute unique information to the overall assessment. The scores for all metrics are then summed to obtain the overall NCIBI score. Appendix II contains more information regarding the NCIBI. During the late 1990s, application of the NCIBI has been restricted to wadeable streams that can be sampled by a crew of 2-4 persons using backpack electrofishers and following the DWQ Standard Operating Procedures (NCDEHNR, 1997). Work began in 1998 to develop a fish community boat sampling method that could be used in nonwadeable coastal plain streams. DWQ plans to sample reference sites with the boat method once it is finalized. As with other biological monitoring programs, many years of reference site data will be needed before solid criteria can be developed to evaluate biological integrity of large streams and rivers using the fish community assessment. Refer to page 57 for further information.

#### **Overview of Fish Community Data**

Appendix II lists all of the fish community collections in the Lumber River basin between 1990 and 2001, giving site location, collection date and NCIBI rating. Fish community samples have been collected at 22 sites in six of the Lumber River subbasins during this assessment period. Due to the ongoing revision in the NCIBI scoring and rating criteria for the Sandhills and Lower Coastal Plain region and the development of evaluation protocols for small boat collecting, no fish community sites were rated. Refer to page 57 for further information.

#### **Lumber River Basin Fish Kills**

DWQ has systematically tracked reported fish kill events across the state since 1996. From 1996 to 2000, DWQ field investigators reported 14 fish kill events in the Lumber River basin. Kill activity extent and fish mortality remained light, never exceeding 50,000. No fish kill reports were received in 1999. Causes listed on kill reports included algal blooms and low dissolved oxygen levels. The extent to which fish kills are related to land use activities is not known. For more information on fish kills in North Carolina, refer to <http://www.esb.enr.state.nc.us/Fishkill/2000killrep.pdf>.

#### **Overview of Fish Tissue Sampling**

One fish tissue survey was conducted by DWQ in the basin in 2000. The purpose of the survey was to analyze fish tissue samples for metal contaminants. The majority of fish tissue samples collected from the Lumber River site near Boardman contained metal contaminants at undetectable levels or at levels less than the EPA, Food and Drug Administration, and State of North Carolina consumption criteria. However, elevated mercury concentrations were detected in bowfin, chain pickerel and largemouth bass. These three species are at the top of the food chain and are most often associated with mercury bioaccumulation in fish tissue in North Carolina. For more information on this issue, refer to page 59. More detailed information regarding this sampling event can be found in the appropriate subbasin chapter (03-07-51) in Section B.

### 3.3.3 Aquatic Toxicity Monitoring

Acute and/or chronic toxicity tests are used to determine toxicity of discharges to sensitive aquatic species (usually fathead minnows or the water flea, *Ceriodaphnia dubia*). Results of these tests have been shown by several researchers to be predictive of discharge effects on receiving stream populations. Many facilities are required to monitor whole effluent toxicity (WET) by their NPDES permit or by administrative letter. Other facilities may also be tested by DWQ's Aquatic Toxicology Unit (ATU). Per Section 106 of the Clean Water Act, the ATU is required to test at least 10 percent of the major discharging facilities over the course of the federal fiscal year (FFY). However, it is ATU's target to test 20 percent of the major dischargers in the FFY. This means that each major facility would get evaluated over the course of their five-year permit. There are no requirements or targets for minor dischargers.

In addition, the ATU maintains a compliance summary for all facilities required to perform tests and provides monthly updates of this information to regional offices and DWQ administration. Ambient toxicity tests can be used to evaluate stream water quality relative to other stream sites and/or a point source discharge.

Twenty-six NPDES permits in the Lumber River basin currently require WET testing. Twenty-four permits have a WET limit; the other facilities have episodic discharges, and their permits specify monitoring but with no limit. The number of facilities required to monitor WET has increased steadily since 1987, the first year that WET limits were written into permits in North Carolina. The compliance rate has risen as well. Since 1996, the compliance rate has stabilized at approximately 85-90 percent. Figure A-13 summarizes WET monitoring compliance in the Lumber River basin from 1987 to 1999. Facilities with toxicity problems during the most recent two-year review period are discussed in Section B subbasin chapters.

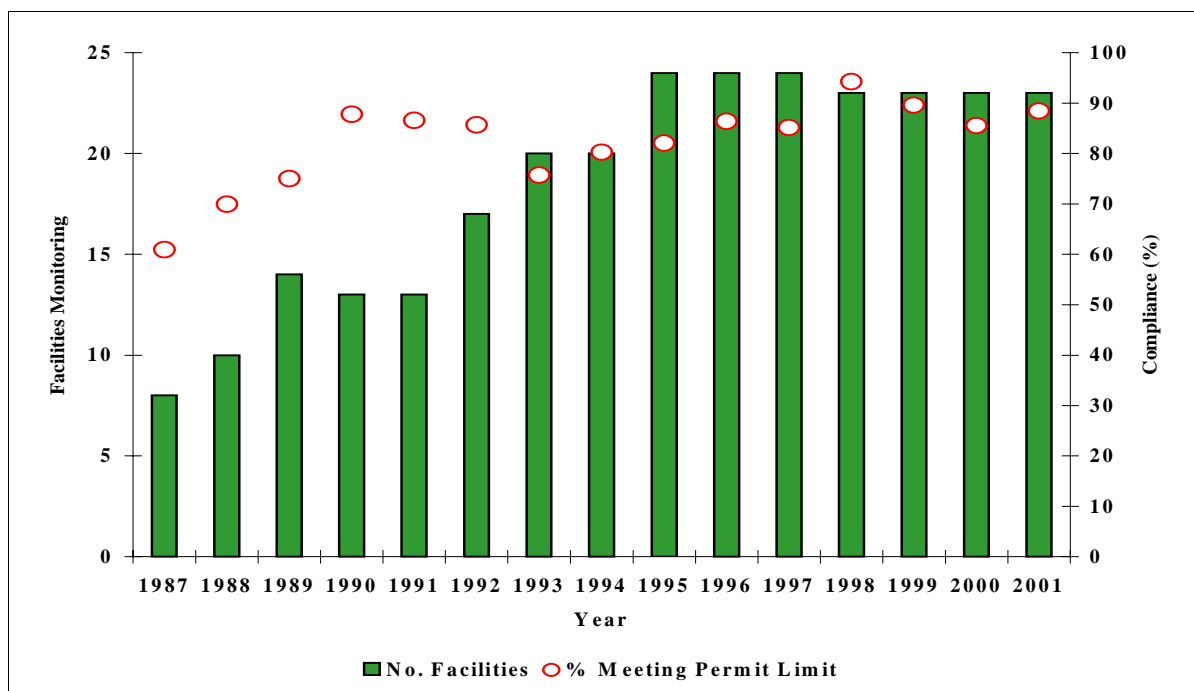


Figure A-13 Summary of Compliance with Aquatic Toxicity Tests in the Lumber River Basin

### **3.3.4 Lakes Assessment Program**

Two lakes in the Lumber River basin were sampled as part of the Lakes Assessment Program in the summer of 2001. These lakes, Pages Lake and Lake Waccamaw, are discussed in the appropriate subbasin chapter (03-07-50 and 03-07-56) in Section B.

### **3.3.5 Ambient Monitoring System**

The Ambient Monitoring System (AMS) is a network of stream, lake and estuarine stations strategically located for the collections of physical and chemical water quality data. North Carolina has more than 420 water chemistry monitoring stations statewide, including 32 stations in the Lumber River basin. Each station is sampled monthly for 27 parameters. The location of these stations are listed in Table A-16 and shown on individual subbasin maps in Section B. Refer to the *2002 Lumber River Basinwide Assessment Report* at <http://www.esb.enr.state.nc.us/bar.html> for more detailed analysis of ambient water quality monitoring data.

### **3.3.6 Division of Environmental Health Shellfish Sanitation and Recreational Water Quality Section**

The Shellfish Sanitation and Recreational Water Quality Section of the Division of Environmental Health is responsible for monitoring and classifying coastal waters as to their suitability for shellfish harvesting for human consumption and inspection and certification of shellfish and crustacea processing plants. The section also administers the Recreational Beach Monitoring Program and posts advisories, under the guidance of the State Health Director, for those waters not suitable for bodily contact activities.

The Shellfish Sanitation Program is conducted in accordance with the guidelines set by the Interstate Shellfish Sanitation Conference (ISSC) contained in the *National Shellfish Sanitation Program (NSSP) Guide for the Control of Molluscan Shellfish Model Ordinance*. The NSSP is administered by the US Food and Drug Administration (FDA). Classifications of coastal waters for shellfish harvesting are done by means of a Sanitary Survey which includes: a shoreline survey of sources of pollution, a hydrographic and meteorological survey, and a bacteriological survey of growing waters. Sanitary Surveys are conducted of all potential shellfish growing areas in coastal North Carolina and recommendations are made to the Division of Marine Fisheries of which areas should be closed for shellfish harvesting.

The Recreational Beach Monitoring Program determines the quality of coastal waters and beaches for suitability for bodily contact activities. Shoreline surveys of potential sources of pollution that could affect the area are also conducted. Swimming advisories are posted when bacteriological standards are exceeded or point source discharges are found.

Water samples are collected and analyzed for fecal coliform bacteria from numerous sampling stations located throughout the coastal area for both the shellfish and recreational programs. The Recreational Monitoring Program also tests waters for *Escherichia coli*.

Table A-16 Locations of Ambient Monitoring Stations in the Lumber River Basin by Subbasin

Station	Location	Water Classification
<b>03-07-50</b> I2090000	Drowning Creek at US 1 near Hoffman	C Sw HQW
<b>03-07-51</b> I2610000 I2750000 I2810000 I3050000 I4650000 I5690000 I6410000	Lumber River at US 401 near Wagram Lumber River at SR 1303 near Maxton Lumber River at NC 71 near Maxton Lumber River at SR 1003 near Pembroke Lumber River at SR 2121 near Kingsdale Lumber River at US 74 at Boardman Lumber River at NC 904 at Fair Bluff	WS-IV & B Sw HQW B Sw HQW B Sw HQW WS-IV & B Sw HQW C Sw C Sw B Sw
<b>03-07-52</b> I3690000 I3730000	Raft Swamp at SR 1527 near Moss Neck Raft Swamp at NC 71 near Red Springs	WS-IV Sw C Sw
<b>03-07-53</b> I5370000	Big Swamp at NC 211 near Richardson	C Sw
<b>03-07-54</b> I6290000	Ashpole Swamp at SR 2258 near Barnesville	C Sw
<b>03-07-55</b> I0490000 I0510000 I1530000	Leiths Creek at SR 1609 near Johns Leiths Creek at SR 1615 near Smyrna Church Shoe Heel Creek at SR 1101 near Rowland	C Sw C Sw C Sw
<b>03-07-56</b> I7730000	Lake Waccamaw at dam spillway	B Sw ORW
<b>03-07-57</b> I8970000 I9310000 I9350000	Waccamaw River at NC 130 at Freeland Seven Creek at NC 905 near Bug Hill Waccamaw River at SC 9 near Longs, SC	C Sw C Sw FW (B Sw)
<b>03-07-59</b> I9380000 I9385000 I9420000 I9440000 I9450000 I9500000 I9510000 I9530000 I9700000 I9820000 I9840000 I9880000 I9916000	ICWW at CM R16 at Beaverdam Creek near Long Beach Montgomery Slough at SR 1105 near Long Beach Lockwood Folly River at NC 211 at Supply Lockwood Folly River at Varnum Lockwood Folly River at CM R8 at W Ch downstream of Varnum Lockwood Folly River at West Channel Islands ICWW at CM R42 West of Lockwood Folly River ICWW at NC 130 near Holdens Beach Shallotte River at Business US 17 at Shallotte Shallotte River at Shell Point near Shallotte ICWW at NC 904 near Ocean Isle ICWW at SR 1172 near Sunset Beach Calabash Creek at NC 179 near Calabash	SA HQW SA HQW SC HQW SA HQW SA HQW SA HQW SA HQW SA HQW SC SA HQW SA HQW SA HQW SA HQW

### 3.4 Other Water Quality Research

North Carolina actively solicits "existing and readily available" data and information for each basin as part of the basinwide planning process. Data meeting DWQ quality assurance objectives are used in making use support determinations. Data and information indicating possible water quality problems are investigated further. Both quantitative and qualitative information are accepted during the solicitation period. High levels of confidence must be present in order for outside quantitative information to carry the same weight as information collected from within DWQ. This is particularly the case when considering waters for the 303(d) list. Methodology for soliciting and evaluating outside data is presented in *North Carolina's 2002 Integrated 305(b) and 303(d) Report* (NCDENR-DWQ, February 2003). There were no data received during the open solicitation period in October 2000. The next data solicitation period for the Lumber River is planned for fall 2005.

#### ***DWQ data solicitation includes the following:***

- Information, letters and photographs regarding the uses of surface waters for boating, drinking water, swimming, aesthetics and fishing.
- Raw data submitted electronically and accompanied by documentation of quality assurance methods used to collect and analyze the samples. Maps showing sampling locations must also be included.
- Summary reports and memos, including distribution statistics and accompanied by documentation of quality assurance methods used to collect and analyze the data.

*Contact information must accompany all data and information submitted.*

### 3.5 Use Support Summary

#### 3.5.1 Introduction to Use Support

Surface waters are classified according to their best intended uses. Determining how well a waterbody supports its uses (*use support* status) is an important method of interpreting water quality data and assessing water quality.

Surface waters are rated *Supporting and Impaired*. These ratings refer to whether the classified uses of the water (such as water supply, aquatic life protection and recreation) are being met. For example, waters classified for fish consumption and aquatic life protection (Class C for freshwater or SC for saltwater) are rated Supporting if data used to determine use support meet certain criteria. However, if these criteria were not met, then the waters would be rated as Impaired. Waters with inconclusive data are listed as Not Rated. Waters lacking data are listed as No Data. More specific methods are presented in Part C of this appendix.

In previous use support assessments, surface waters were rated fully supporting (FS), partially supporting (PS), not supporting (NS) and not rated (NR). FS was used to identify waters that were meeting their designated uses. Impaired waters were rated PS and NS, depending on their degree of degradation. NR was used to identify waters lacking data or having inconclusive data. The 2002 Integrated Water Quality Monitoring and Assessment Report Guidance issued by the EPA requested that states no longer subdivide the Impaired category. In agreement with this

guidance, North Carolina no longer subdivides the Impaired category and rates waters as Supporting, Impaired, Not Rated or No Data.

Historically, the Supporting use support rating was also subdivided into fully supporting (FS) and fully supporting but threatened (ST). ST was used to identify waters that were fully supporting but had some notable water quality concerns and could represent constant, degrading or improving water quality conditions. North Carolina's past use of ST was very different from that of the US Environmental Protection Agency (EPA), which uses it to identify waters that demonstrate declining water quality (EPA Guidelines for Preparation of the Comprehensive State Water Quality Assessments [305(b) Reports] and Electronic Updates, 1997). Given the difference between the EPA and North Carolina definitions of ST and the resulting confusion that arose from this difference, North Carolina no longer subdivides the supporting category. However, these waters and the specific water quality concerns are identified in the Section B subbasin chapters so that data, management and the need to address the identified concerns are presented.

Use support methods have been developed to assess ecosystem health and human health risk through the development of use support ratings for six categories: aquatic life, recreation, fish consumption, shellfish harvesting, water supply and "other" uses. These categories are tied to the uses associated with the primary classifications applied to NC rivers, streams and lakes. A single water could have more than one use support rating corresponding to one or more of the six use support categories. For many waters, a use support category will not be applicable (N/A) to the use classification of that water (e.g., shellfish harvesting is only applied to Class SA waters). A full description of the classifications is available in the DWQ document titled: *Classifications and Water Quality Standards Applicable to Surface Waters of North Carolina*. For more detailed information regarding use support methodology, refer to Appendix III.

### **3.5.2 Comparison of Use Support Ratings to Streams on the Section 303(d) List**

Section 303(d) of the Clean Water Act requires states to identify waters not meeting standards. EPA must then provide review and approval of the listed waters. A list of waters not meeting standards is submitted to EPA biennially. Waters placed on this list, termed the 303(d) list, require the establishment of total maximum daily loads (TMDLs) intended to guide the restoration of water quality. See Appendix IV for a description of 303(d) listing methodology.

Waters are placed on North Carolina's 303(d) list primarily due to use support rating of impairment. These use support ratings are based on biological and chemical data and, for some categories, human health advisories. When the state water quality standard is exceeded, then this constituent is listed as the problem parameter. TMDLs must be developed for problem parameters on the 303(d) list. Other strategies may be implemented to restore water quality; however, the waterbody must remain on the 303(d) list until improvement has been realized based on either biological bioclassifications or water quality standards.

The 303(d) list and accompanying data are updated as the basinwide plans are revised. In some cases, the new data will demonstrate water quality improvement and waters may receive a better use support rating. These waters may be removed from the 303(d) list when water quality standards are attained. In other cases, the new data will show a stable or decreasing trend in



overall water quality resulting in the same, or lower, use support rating. Attention remains focused on these waters until water quality standards are met. Currently, there are 11 waters listed on the *North Carolina's 2002 Integrated 305(b) and 303(d) Report* in the Lumber River basin. These waters are listed for fish consumption advisories related to mercury. These waters have not been monitored, but still are considered Impaired on an evaluated basis due to the current fish consumption advice from the NC Department of Health and Human Services. Refer to Appendix III and page 59 for more information.

### 3.5.3 Use Support Ratings for the Lumber River Basin

#### Aquatic Life

The aquatic life use support category is applied to all waters in North Carolina. Therefore, this category is applied to all 2,232.5 stream miles, 8,965.9 freshwater acres, 4,306.6 estuarine acres, and the 25.6 miles of Atlantic coastline in the Lumber River basin. Table A-17 presents the aquatic life use support ratings by subbasin for all waters in basin.

Table A-17 Aquatic Life Use Support Ratings for All Waters Listed by Subbasin (1996-2001)

Subbasin	Units	Supporting	Impaired	Not Rated	No Data	Total
03-07-50	miles	66.2	0	50.9	63.6	180.7
	acres	35.2	0	0	78.8	114.0
03-07-51	miles	136.7	0	45.2	224.0	405.9
	acres	0	0	0	0	0
03-07-52	miles	37.0	0	19.9	85.4	142.3
	acres	0	0	0	0	0
03-07-53	miles	15.4	0	52.0	261.7	329.1
	acres	0	0	0	0	0
03-07-54	miles	25.7	0	6.7	57.7	91.1
	acres	0	0	0	11.8	11.8
03-07-55	miles	106.5	0	28.5	125.2	260.3
	acres	0	0	0	0	0
03-07-56	miles	10.5	0	11.6	75.9	98.0
	acres	8,840.2	0	0	0	8,840.0
03-07-57	miles	41.2	0	38.7	278.7	358.6
	acres	0	0	0	0	0
03-07-58	miles	0	0	29.5	191.0	220.5
	acres	0	0	0	0	0
03-07-59	miles	12.7	0	15.4	117.8	145.9
	acres	0	0	0	0	0
	Est. acres*	2,170.0	0	0	2,136.5	4,306.6
	coast**	0	0	0	25.6	25.6
Total	miles	451.9	0	299.4	1,481.2	2,232.5
	acres	8,875.3	0	0	90.6	8,965.9
	Est. acres*	2,170.0	0	0	2,136.5	4,306.6
	coast**	0	0	0	25.6	25.6

\* Indicates saltwater (estuarine) acres; all other acres are freshwater acres.

\*\* Indicates miles of Atlantic coastline in the Lumber River basin, not added to total mileage.

Approximately 32 percent of stream miles (723.1 miles) were monitored for aquatic life; there were no Impaired stream miles, freshwater acres or estuarine acres. Approximately 99 percent of freshwater acres (8,875.3 acres) and 50 percent of estuarine acres (2,170.0 acres) were monitored for aquatic life. Table A-18 summarizes aquatic life use support ratings for the entire basin.

Table A-18 Aquatic Life Use Support Summary Information for Waters in the Lumber River Basin (1996-2001)

Aquatic Life Use Support Ratings	All Waters	Percent of All Waters	Monitored Waters	Percent of Monitored Waters
<b>Supporting</b>	451.9 miles 8,875.3 acres 2,170.0 Est. acres	20.2 99.0 50.4	447.6 miles 8,875.3 acres 2,170 Est. acres	61.9 100.0 100.0
<b>Impaired</b>	0 miles 0 acres 0 Est. acres	0 0 0	0 miles 0 acres 0 Est. acres	0 0 0
<b>Not Rated</b>	299.4 miles 0 acres 0 Est. acres	13.4 0 0	275.5 miles 0 acres 0 Est. acres	38.1 0 0
<b>No Data**</b>	1,481.2 miles 90.6 acres 2,136.5 Est. acres	68.0 1.0 49.6	N/A N/A N/A	N/A N/A N/A
<b>TOTAL</b>	2,232.5 miles 8,965.9 acres 4,305.5 Est. acres		723.1* miles 8,875.3* acres 2,170.0* Est. acres	

Note: Est. acres indicate saltwater (estuarine) acres; all other acres are freshwater acres.

\* 32.4 percent of all stream miles, 98.9 percent of all freshwater acres, and 50.4 estuarine acres were monitored.

\*\* There are also 25.6 miles of Atlantic coastline with No Data, not added to total mileage.

## **Fish Consumption**

Like the aquatic life use support category, the fish consumption category is also applied to all waters in the state. Approximately 1 percent of stream miles (21.5 miles) and 100 percent of coastline miles (25.6 coastline miles) were monitored for fish consumption. Fish consumption use support ratings are based on fish consumption advice or specific advisories issued by the NC Department of Health and Human Services (NCDHHS). Refer to page 59 for more information on this issue. If a limited fish consumption advice, advisory or a no consumption advisory is posted at the time of use support assessment, the water is rated Impaired. For details about how use support determinations are made, refer to Appendix III.

Table A-19 presents use support ratings by subbasin in the fish consumption use support category. Due to high levels of mercury in three freshwater and four saltwater fish species, the NC Division of Public Health has issued broad health advice for consumption of these fish caught south and east of Interstate 85. For details about these advisories, refer to the discussion beginning on page 59. A basinwide summary of current fish consumption use support ratings is presented in Table A-20.

Fish tissue was monitored in only 1 percent of stream miles (21.5) and 100 percent (25.6 coastline miles) in the Lumber River basin for the fish consumption use support category during this basinwide planning cycle. A basinwide summary of current fish consumption ratings is presented in Table A-20. Twenty-two fish tissue samples were collected from the Lumber River at US 74 at Boardman during this basinwide cycle. All but two samples contained elevated methylmercury levels that exceeded the state's recommended criteria. See Section B, Chapter 2 for further discussion.

Table A-19 Fish Consumption Use Support Ratings for All Waters Listed by Subbasin (1996-2001)

Subbasin	Units	Impaired
03-07-50	miles	180.7
	acres	114.0
03-07-51	miles	405.9
	acres	0
03-07-52	miles	142.3
	acres	0
03-07-53	miles	329.1
	acres	0
03-07-54	miles	91.1
	acres	11.8
03-07-55	miles	260.3
	acres	0
03-07-56	miles	98.0
	acres	8,840.0
03-07-57	miles	358.6
	acres	0
03-07-58	miles	220.5
	acres	0
03-07-59	miles	145.9
	acres	0
	Est. acres*	4,306.6
	coast**	25.6
Total	miles	2,232.5
	acres	8,965.9
	Est. acres*	4,306.6
	coast**	25.6

\* Indicates saltwater (estuarine) acres; all other acres are freshwater acres.

\*\* Indicates miles of Atlantic coastline in the Lumber River basin, not added to total mileage.

Table A-20 Fish Consumption Use Support Summary Information for Waters in the Lumber River Basin (1996-2001)

<b>Fish Consumption</b>	<b>All Waters</b>	<b>Monitored Waters</b>	<b>Percent Monitored</b>
<b>Supporting</b>	0 miles 0 acres 0 Est. acres	0 miles 0 acres 0 Est. acres	0 0 0
<b>Impaired</b>	2,232.5 miles 8,965.9 acres 4,306.6 Est. acres 25.6 coast	21.5 miles 0 acres 0 Est. acres 25.6 coast	1 0 0 100
<b>Not Rated</b>	0 miles 0 acres 0 Est. acres	0 miles 0 acres 0 Est. acres	0 0 0
<b>TOTAL</b>	2,232.5 miles 8,965.9 acres 4,306.6 Est. acres 25.6 coast	21.5 miles 0 acres 0 Est. acres 25.6 coast	1 0 0 100

Note: Est. acres indicate saltwater (estuarine) acres; all other acres are freshwater acres.

Coast indicates miles of Atlantic coastline in the Lumber River basin.

## **Recreation**

Like the aquatic life use support category, the recreation category is also applied to all waters in the state. Table A-21 presents use support ratings by subbasin for all waters in the recreation use support category. Approximately 12 percent of stream miles (262.2 miles) were monitored by DWQ. There were no stream miles, freshwater acres or estuarine acres Impaired in the recreation use support category. Approximately 99 percent of freshwater acres and 47 percent of estuarine acres were monitored. Table A-22 summarizes recreation use support ratings for the entire basin.

Table A-21 Recreation Use Support Ratings for All Waters Listed by Subbasin (1996-2001)

Subbasin	Units	Supporting	Impaired	Not Rated	No Data	Total
03-07-50	miles	15.7	0	0	165.0	180.7
	acres	0	0	0	114.0	114.0
03-07-51	miles	75.5	0	0	330.5	405.9
	acres	0	0	0	0	0
03-07-52	miles	37.0	0	0	105.3	142.3
	acres	0	0	0	0	0
03-07-53	miles	15.4	0	0	313.7	329.1
	acres	0	0	0	0	0
03-07-54	miles	6.9	0	0	84.2	91.1
	acres	0	0	0	11.8	11.8
03-07-55	miles	52.1	0	5.1	203.1	260.3
	acres	0	0	0	0	0
03-07-56	miles	0	0	0	98.0	98.0
	acres	8,840.2	0	0	0	8,840.2
03-07-57	miles	32.3	0	0	326.3	358.6
	acres	0	0	0	0	0
03-07-58	miles	0	0	0	220.5	220.5
	acres	0	0	0	0	0
03-07-59	miles	22.1	0	0	123.7	146.5
	acres	0	0	0	0	0
	Est. acres*	2,039.2	0	0	2,267.3	4,305.5
	coast**	25.6	0	0	0	25.6
Total	miles	257.1	0	5.1	1,970.3	2,232.5
	acres	8,840.2	0	0	125.7	8,965.9
	Est. acres*	2,039.2	0	0	2,267.3	4,306.6
	coast**	25.6	0	0	0	25.6

\* Indicates saltwater (estuarine) acres; all other acres are freshwater acres.

\*\* Indicates miles of Atlantic coastline in the Lumber River basin (not added to mileage total).

Table A-22 Recreation Use Support Summary for Waters in the Lumber River Basin (1996-2001)

Recreation	All Waters	Monitored Waters	Percent of Monitored Waters
<b>Supporting</b>	257.1 miles 8,840.2 acres 2,039.2 Est. acres 25.6 coast	257.1 miles 8,840.2 acres 2,039.2 Est. acres 25.6 coast	11.5 98.6 47.4 100
<b>Impaired</b>	0 miles 0 acres 0 Est. acres	0 miles 0 acres 0 Est. acres	0 0 0
<b>Not Rated</b>	5.1 miles 0 acres 0 Est. acres 0 coast	5.1 miles 0 acres 0 Est. acres 0 coast	0.2 0 0 0
<b>No Data</b>	1,970.3 miles 125.7 acres 2,276.3 Est. acres	N/A miles N/A acres N/A Est. acres	N/A N/A N/A
<b>TOTAL</b>	2,232.5 miles 8,965.9 acres 4,306.6 Est. acres 25.6 coast	262.2 miles 8,840.2 acres 2,039.2 Est. acres 25.6 coast	

Note: Est. acres indicate saltwater (estuarine) acres; all other acres are freshwater acres.

Coast indicates miles of Atlantic coastline in the Lumber River basin.

### **Water Supply**

There are 216.7 stream miles currently classified for water supply in the Lumber River basin. All water supply waters are Supporting on an evaluated basis based on reports from DEH regional water treatment consultants.

### **Shellfish Harvesting**

There are 4,280.8 estuarine acres classified for shellfish harvesting (Class SA) in the Lumber River basin. All were monitored during the past five years by DEH Shellfish Sanitation (refer to page 45). Table A-23 presents use support ratings by subbasin for all waters in the shellfish harvesting use support category. Impaired estuarine acres accounted for 15.7 percent of the total estuarine acres in the shellfish harvesting use support category. A basinwide summary of current shellfish harvest use support ratings is presented in Table A-24.

Table A-23 Shellfish Harvesting Use Support Ratings for All Waters Listed by Subbasin (1996-2001)

Subbasin	Units	Supporting	Impaired	Not Rated	No Data	Total
03-07-59	acres	673.9	3,606.9	0	0	4,280.8
Total	acres	673.9	3,606.9	0	0	4,280.8

Table A-24 Shellfish Harvesting Use Support Summary Information for Waters in the Lumber River Basin (1996-2001)

Shellfish Harvesting	Monitored Waters	Percent of Monitored
Supporting	673.9 acres	15.7
Impaired	3,606.9 acres	84.3
Not Rated	0 acres	0
TOTAL	4,280.8 acres	100

### **Impaired Waters**

Table A-25 presents Impaired waters (in all categories) in the Lumber River basin that were monitored by DWQ within the last five years. The use support category for which a water is Impaired is indicated in the table. Descriptions of Impaired segments, as well as problem parameters, are outlined in Appendix III. Management strategies for each water are discussed in detail in the appropriate subbasin chapter. Maps showing current use support ratings for waters in the Lumber River basin are presented in each subbasin chapter in Section B.

Table A-25 Monitored Impaired Waters within the Lumber River Basin (as of 2003)

Waterbody	Subbasin	Chapter in Section B	Classification	Miles	Acres	Use Support Category
Lumber River *	03-07-51	2	C Sw	21.5	0.0	Fish Consumption
Intracoastal Waterway	03-07-59	10	SA	0.0	2,117.6	Shellfish Harvesting
Lockwoods Folly River	03-07-59	10	SA	0.0	606.2	Shellfish Harvesting
Mill Creek	03-07-59	10	SA	0.0	2.0	Shellfish Harvesting
Mullet Creek	03-07-59	10	SA	0.0	5.7	Shellfish Harvesting
Lockwoods Creek	03-07-59	10	SA	0.2	0.0	Shellfish Harvesting
Spring Creek	03-07-59	10	SA	0.0	2.4	Shellfish Harvesting
Shallotte River	03-07-59	10	SA	0.0	647.3	Shellfish Harvesting
The Mill Pond	03-07-59	10	SA	0.0	2.8	Shellfish Harvesting
Sams Branch	03-07-59	10	SA	0.6	0.0	Shellfish Harvesting
The Swash	03-07-59	10	SA	0.0	3.9	Shellfish Harvesting
Shallotte Creek	03-07-59	10	SA	0.0	135.6	Shellfish Harvesting
Saucepan Creek	03-07-59	10	SA	0.0	62.6	Shellfish Harvesting
Jinnys Branch	03-07-59	10	SA	0.0	1.0	Shellfish Harvesting
Goose Creek	03-07-59	10	SA	0.0	4.2	Shellfish Harvesting
Big Gut Slough	03-07-59	10	SA	0.0	0.3	Shellfish Harvesting
Kilbart Slough	03-07-59	10	SA	0.0	0.7	Shellfish Harvesting
Calabash River	03-07-59	10	SA	0.0	3.4	Shellfish Harvesting
Hangman Branch	03-07-59	10	SA	0.0	10.2	Shellfish Harvesting
Atlantic Coastline *	03-07-59	10	SB	25.6	0.0	Fish Consumption

\* Although all waters in the basin are considered Impaired for the fish consumption use support category, only the Lumber River (21.5 miles) and the Atlantic coastline (25.6 miles) were monitored (see page 59).



# Section A - Chapter 4

## Water Quality Issues Related to Multiple Watersheds in the Lumber River Basin

### 4.1 Introduction

This chapter reviews the status of specific recommendations made for multiple watersheds in the 1999 Lumber River Basinwide Water Quality Plan. Current status and future recommendations are provided for each recommendation. Some of these recommendations were pertinent to several watersheds or the basin as a whole, while others were specific to a particular stream or area within a subbasin. Status of the more specific recommendations is reported within the subbasin chapters in Section B. This chapter also discusses water quality problems that were commonly noted during the most recent use support assessment (1996-2001). Specific waters where these problems were observed are described in Section B. Current status and future recommendations are discussed for each water quality problem.

### 4.2 Biological Criteria for Assessment of Aquatic Life

DWQ strives to properly evaluate the health of aquatic biological communities throughout the state. Swamp stream systems, small streams and estuarine waters have presented unique challenges for benthic macroinvertebrate evaluation, while nonwadeable waters and trout streams have done the same for fish community evaluations. This section discusses some of these challenges. Refer to Appendix II for further information.

#### 4.2.1 Assessing Benthic Macroinvertebrates in Swamp Streams

##### Current Status

Extensive evaluation, conducted by DWQ, of swamp streams across eastern North Carolina suggests that different criteria must be used to assess the condition of water quality in these systems. Swamp streams are characterized by seasonally interrupted flows, lower dissolved oxygen and often lower pH. They also may have very complex braided channels and dark-colored water. Since 1995, benthic macroinvertebrates swamp sampling methods have been used at over 100 sites in the coastal plain of North Carolina, including more than 20 reference sites. Preliminary investigations indicate that there are at least five unique swamp ecoregions in the NC coastal plain, and each of these may require different biocriteria. The lowest "natural" diversity has been found in low-gradient streams (especially in the outer coastal plain) and in areas with poorly drained soils.

DWQ has developed a multi-metric system to refine biological criteria to assign bioclassifications to these streams (as is currently done for other streams and rivers across the state). However, validation of this swamp criteria was not finalized and approved during this Lumber River basinwide assessment (1996-2001) but will be used to assign bioclassifications in the next five-year period. DWQ was required to collect data for several years from swamp stream reference sites. Now, DWQ can properly evaluate such things as: year-to-year variation

at reference swamp sites, effects of flow interruption, variation among reference swamp sites, and the effect of small changes in pH on the benthic macroinvertebrate community.

#### 2003 Recommendations

As of December 2002, DWQ has finalized and approved the biological swamp criteria. Assessment using the finalized swamp criteria will first be used in the Tar-Pamlico River basin. The next *Lumber River Basinwide Water Quality Plan* (2008) will contain use support on swamp streams from the finalized criteria.

### **4.2.2 Assessing Benthic Macroinvertebrate Communities in Small Streams**

#### Current Status

The benthic macroinvertebrate community of small streams is naturally less diverse than the streams used to develop the current criteria for flowing freshwater streams. The benthic macroinvertebrate database is being evaluated, and a study to systematically look at small reference streams in different ecoregions is being developed with the goal of finding a way to evaluate water quality conditions in such small streams.

Presently, a designation of Not Impaired may be used for flowing waters that are too small to be assigned a bioclassification (less than 4 meters in width), but meet the criteria for a Good-Fair or higher bioclassification using the standard qualitative and EPT criteria. This designation will translate into a use support rating of Supporting. However, DWQ will use the monitoring information from small streams to identify potential impacts to small streams even in cases when a use support rating cannot be assigned. Gum Swamp, site B-3, in subbasin 03-07-51 (Section B, Chapter 2) is the only site in the basin which received a Not Impaired bioclassification.

#### 2003 Recommendations

DWQ will use this monitoring information to identify potential impacts to these waters even though a use support rating is not assigned. DWQ will continue to develop criteria to assess water quality in small streams.

### **4.2.3 Assessing Fish Communities**

#### Current Status

Fish communities in most wadeable streams can be sampled by a crew of 2-4 persons using backpack electrofishers and following the DWQ Standard Operating Procedures. The data are evaluated using the North Carolina Index of Biotic Integrity (NCIBI) (NCDENR-DWQ, 2001). The NCIBI uses a cumulative assessment of 12 parameters or metrics. Each metric is designed to contribute unique information to the overall assessment. The scores for all metrics are then summed to obtain the overall NCIBI score.

#### 2003 Recommendations

In order to obtain data from nonwadeable coastal plain streams (that are difficult to evaluate using benthic macroinvertebrates), a fish community boat sampling method is being developed with the goal of expanding the geographic area that can be evaluated using fisheries data. This project may take many years to complete. DWQ will continue to use this monitoring

information to identify potential impacts to these waters even though a use support rating is not assigned.

### **4.3 Mercury Contamination and Fish Consumption**

In April 2002, the NC Department of Health and Human Services (NCDHHS) developed new guidelines to advise people as to what fish are safe to eat. DWQ considers uses of waters with a consumption advice or advisory for one or more species of fish to be Impaired. Elevated methylmercury levels have been found in shark, swordfish, king mackerel, tilefish, largemouth bass, bowfin (or blackfish) and chain pickerel (or jack), and these fish species fall under the NCDHHS guidelines.

#### **4.3.1 Mercury-Related Fish Consumption Information**

The presence and accumulation of mercury in North Carolina's aquatic environment are similar to contamination observed throughout the country. Mercury has a complex life in the environment, moving from the atmosphere to soil, to surface water and into biological organisms. Mercury circulates in the environment as a result of natural and human (anthropogenic) activities. A dominant pathway of mercury in the environment is through the atmosphere. Mercury that has been emitted from industrial and municipal stacks into the ambient air can circulate across the globe. At any point, mercury may then be deposited onto land and water. Once in the water, mercury can accumulate in fish tissue and humans. Mercury is also commonly found in wastewater. However, mercury in wastewater is typically not at levels that could be solely responsible for elevated levels in fish.

The NC Department of Health and Human Services issues fish consumption advisories and advice for those fish species which have median and/or average methylmercury levels of 0.4 mg/kg or greater. These fish include shark, swordfish, king mackerel, tilefish as well as largemouth bass, bowfin (or blackfish) and chain pickerel (or jack) in North Carolina waters south and east of Interstate 85. As a result of this advice, DWQ considers all waters in the Lumber River basin to be Impaired for the fish consumption use support category. Refer to Appendix III for more information regarding use support ratings and assessment methodology.

DWQ has sampled fish tissue from one location on the Lumber River mainstem. Refer to subbasin chapter 03-07-51 for more information.

#### **Fish Consumption Advice**

Fish is an excellent source of protein and other nutrients. However, several varieties of freshwater fish may contain high levels of mercury, which may pose a risk to human health. These guidelines will help you make healthy food choices. A "meal" is defined as six ounces of cooked fish for adults and children 15 years or older and two ounces of cooked fish for younger children.

Women of childbearing age (15-44 years), pregnant or nursing women, and children under 15:

- Do not eat shark, swordfish, tilefish or king mackerel; or blackfish (bowfin), largemouth bass or jack fish (chain pickerel) caught in North Carolina waters south and east of Interstate 85. These fish likely contain high concentrations of mercury.
- Eat up to two meals per week of other fish.

Men, other women, and children 15 years and older:

- Eat no more than one meal per week of shark, swordfish, tilefish or king mackerel; or blackfish (bowfin), largemouth bass or jack fish (chain pickerel) caught in North Carolina waters south and east of Interstate 85. These fish likely contain high concentrations of mercury.
- Eat up to four meals per week of other fish.

For more information regarding fish consumption, visit the NC Department of Health and Human Services website at <http://www.schs.state.nc.us/epi/fish/current.html> or call (919) 733-3816.

#### **4.3.2 2003 Recommendations**

##### *Improved Ambient Sampling Techniques*

DWQ aims to stay abreast of new technology and sampling techniques to ensure that water quality data are accurate, precise and of highest value. In 2000, DWQ started training water quality sampling staff on the new EPA Method 1631 technique. Current monitoring using a higher detection limit (EPA Method 245.1) has consistently yielded non-detected values, and DWQ aims to use the 1631 Method to allow detection levels three orders of magnitude lower than EPA Method 245.1.

##### *NC Eastern Regional Mercury Study*

In an effort to better manage state waters that may have methylmercury issues, DWQ initiated a study using grant funding from EPA Region IV. The study aims to provide information that may be used in water quality standard and TMDL development. The study goals include:

- determining levels of ambient mercury in the surface water system;
- estimating site-specific total mercury: methylmercury translators to evaluate water quality criteria;
- develop site-specific water to fish bioaccumulation factors; and
- determine levels of mercury in treatment plant effluent.

DWQ aims to complete this study in April 2004, and results will be available to the public. For more information, contact the DWQ Planning Branch Modeling/TMDL Supervisor at (919) 733-5083.

##### *DWQ Mercury Workgroup*

DWQ is committed to characterizing methylmercury exposure levels and determining if NPDES sources need to be controlled. DWQ formed an internal Mercury Workgroup to improve communication from all programs which directly affect mercury issues (i.e., Pretreatment, Environmental Sciences, Basinwide Planning, etc.). The workgroup meets as needed to share

information and determine next steps in addressing mercury issues associated with the aquatic environment.

DWQ will continue to host an internal workgroup to stay abreast of current mercury issues. The public has voiced concerns that DWQ should be working on the ecological components and consequences of mercury bioavailability to biota in these areas and the biogeochemical cycling and production of methylmercury from associated wetlands along these streams.

DWQ will continue to monitor concentrations of various contaminants in fish tissue across the state and will work to identify and reduce wastewater contributions of mercury to surface waters. The Division of Air Quality (DAQ) evaluates mercury levels in rainwater on a regular basis through the EPA Mercury Deposition Network. EPA continues to focus on nationwide mercury reductions from stack emissions and through pollution prevention efforts. Pollution prevention efforts are being investigated on a state and federal level to reduce mercury emissions. Additionally, a significant historical source of atmospheric mercury deposition from the Holtrachem plant in Columbus County ceased operations in October 2000. The facility was a former chlor-alkali manufacturing plant that produced chlorine, sodium hydroxide, sodium hypochlorite and hydrochloric acid using the mercury cell process.

#### *NPDES Mercury Requirement, Implementation of EPA Method 1631*

NPDES permittees have worked with the state to reduce potential risks from this pollutant, including tasks associated with collecting and reporting more accurate data. The most commonly used laboratory analysis for total mercury (EPA Method 245.1) has a method detection level of 0.2 µg/l, while the current water quality standard is an order of magnitude lower at 0.012 µg/l. Thus, true compliance with the water quality standard could not be judged. A more recently approved laboratory method (EPA Method 1631) has a detection level below the water quality standard (0.0005 µg/l), which would allow the Division to assess potential water quality impacts from dischargers more accurately.

A total of 155 facilities statewide will be required to use EPA Method 1631 (or subsequent low level mercury methods approved by EPA in 40 CFR 136) when analyzing for total mercury beginning September 1, 2003. These facilities are subject to this new requirement because of either criteria: 1) the facility has a current total mercury limit in its NPDES permit that is <0.20 µg/l; or 2) the facility has limited instream dilution (i.e., the instream waste concentration (IWC) is >6 percent). This requirement complies with 15 A NCAC 2B.0505(e)(4), which requires that "test procedures must produce detection and reporting levels below the permit discharge requirements".

There are ten facilities in the Lumber River basin which are required to analyze for total mercury using EPA Method 1631. For more information on NPDES Mercury requirement, visit the NPDES permitting website at <http://h2o.enr.state.nc.us/NPDES/NPDESweb.html> or contact the DWQ Point Source Branch/NPDES Supervisor at (919) 733-5083.

#### *Lumber River Basin Mercury TMDL Report*

The Lumber River basin currently has several waters listed on the North Carolina 303(d) List for fish consumption advisories related to mercury (see Appendix V). Section 303(d) of the Clean Water Act (CWA) requires states to develop a list of waters not meeting water quality standards

or which have Impaired uses. The 303(d) process requires that a Total Maximum Daily Load (TMDL) be developed for each of the listed waters, where technically feasible. A TMDL, titled *TMDL Study: Mercury Loads to Impaired Waters in the Lumber River Basin, North Carolina*, was developed by DWQ and approved by EPA in 2000. This TMDL describes sources and allowable Hg loads to surface waters.

Past fish consumption advisories for waters in the Lumber River basin have primarily been in the Lumber River and Waccamaw River watersheds. There are four aquatic point source dischargers in the Lumber River watershed and one in the Waccamaw River watershed that analyze effluent for mercury. However, these aquatic point sources are not believed to be the most significant source of mercury to surface waters in these watersheds. Rather, a significant portion of mercury sources is believed to be from atmospheric sources. Mercury emissions to the atmosphere have increased since the industrial revolution. Local deposition of mercury occurs near an atmospheric point source; however, much of the atmospheric mercury can travel across countries and continents.

During this basin cycle, NPDES permit limits will be issued to facilities that show a reasonable potential to exceed state water quality standards. Other facilities may be asked to monitor effluent for mercury if it is likely that mercury is present in the effluent. Current and future NPDES discharges in the Lumber River and Waccamaw River watershed will not be allowed to increase the total mercury already present in the system.

Even with restrictions on point sources, mercury levels in the Lumber River and Waccamaw River fish are not likely to change appreciably over the next several years. Thus, efforts should be made to educate the public in and around the Lumber River and Waccamaw River watersheds with regard to mercury pollution.

The State of North Carolina alone cannot eliminate the atmospheric deposition of mercury over surface waters. Actions for reducing atmospheric mercury will also be needed at the national and international levels. The Mercury Report to Congress (EPA, 1997) lists initiatives under the Clean Air Act that may reduce atmospheric mercury emissions from industrial sources. The most significant initiative is emission limits for municipal waste combustors and medical waste incinerators.

North Carolina, in conjunction with EPA, will need to assess the relative inputs of mercury from within and outside the state using a regional air quality model. Modeling results may indicate that a significant portion of the mercury load to the Lumber River and Waccamaw River watersheds is not due to local sources. In this case, assistance will be needed from EPA to address mercury emissions reductions across river basins and state boundaries.

#### **4.4 Habitat Degradation**

Instream habitat degradation is identified in the use support summary (Appendix III) where there is a notable reduction in habitat diversity or a negative change in habitat. This term includes sedimentation, bank erosion, channelization, lack of riparian vegetation, loss of pools or riffles, loss of woody habitat, and streambed scour. Good instream habitat is necessary for aquatic life to survive and reproduce. Streams that typically show signs of habitat degradation are in

watersheds that have a large amount of land-disturbing activities (construction, mining, timber harvest and agricultural activities) or a large percentage of impervious surfaces. A watershed in which most of the riparian vegetation has been removed from streams or channelization has occurred also exhibits instream habitat degradation. Streams that receive a discharge quantity that is much greater than the natural flow in the stream often have degraded habitat as well.

Determining the cause and quantifying amounts of habitat degradation is very difficult in most cases. To assess instream habitat degradation in most streams would require extensive technical and monetary resources and perhaps even more resources to restore the stream. Although DWQ and other agencies are starting to address this issue, local efforts are needed to prevent further instream habitat degradation and to restore streams that have been Impaired by activities that cause habitat degradation. As point sources become less of a source of water quality impairment, nonpoint sources that pollute water and cause habitat degradation need to be addressed to further improve water quality in North Carolina's streams and rivers.

### ***Some Best Management Practices***

#### **Agriculture**

- Using no till or conservation tillage practices
- Fencing livestock out of streams and rivers
- Leaving natural buffer areas around small streams and rivers

#### **Construction**

- Using phased grading/seeding plans
- Limiting time of exposure
- Planting temporary ground cover
- Using sediment basins and traps

#### **Forestry**

- Controlling runoff from logging roads
- Replanting vegetation on disturbed areas
- Leaving natural buffer areas around small streams and rivers

#### **4.4.1 Land Clearing Activities**

Erosion and sedimentation can be controlled during most land-disturbing activities by using appropriate BMPs. In fact, substantial amounts of erosion can be prevented by planning to minimize the (1) amount and (2) time the land is exposed. DWQ's role in sediment control is to work cooperatively with those agencies that administer sediment control programs in order to maximize the effectiveness of the programs and to protect water quality. Where programs are not effective, as evidenced by a violation of instream water quality standards, and where DWQ can identify a source, then appropriate enforcement action can be taken. Generally, this entails requiring the landowner or responsible party to install acceptable BMPs.

As a result of new stormwater rules enacted by EPA in 1999, construction or land development activities that disturb one acre or more are required to obtain a NPDES stormwater permit (refer to page 69). An erosion and sediment control plan must also be developed and approved for these sites under the state's Sedimentation Pollution Control Act (SPCA) administered by the NC Division of Land Resources. Site disturbances of less than one acre are required to use BMPs, but a plan is not required.

Forestry operations in North Carolina are subject to regulation under the Sedimentation Pollution Control Act of 1973 (G.S. Chapter 113A, Article 4 referred to as "SPCA"). However, forestry operations may be exempted from the permit requirements in the SPCA, if the operations meet compliance standards outlined in the *Forest Practices Guidelines Related to Water Quality* (15A

NCAC 11 .0101-.0209, referred to as "FPGs") and General Statutes regarding stream obstruction (G.S. 77-13 and G.S. 77-14). Detailed information is available on the Water Quality Section of the DFR's website at <http://www.dfr.state.nc.us>.

For agricultural activities which are not subject to the SPCA, sediment controls are carried out on a voluntary basis through programs administered by several different agencies (see Appendix VI for further information).

#### **4.4.2 Loss of Riparian Vegetation**

During the 2001 basinwide sampling, DWQ biologists reported degradation of aquatic communities at several sites throughout the Lumber River basin in association with narrow or nonexistent zones of native riparian vegetation. Riparian vegetation loss was common in rural and residential areas as well as in urban areas (NCDENR-DWQ, June 2002).

Removing trees, shrubs and other vegetation to plant grass or place rock (also known as riprap) along the bank of a river or stream degrades water quality. Removing riparian vegetation eliminates habitat for aquatic macroinvertebrates that are food for trout and other fish. Rocks lining a bank absorb the sun's heat and warm the water. Some fish require cooler water temperatures as well as the higher levels of dissolved oxygen cooler water provides. Trees, shrubs and other native vegetation cool the water by shading it. Straightening a stream, clearing streambank vegetation, and lining the banks with grass or rock severely impact the habitat that aquatic insects and fish need to survive.

Livestock grazing with unlimited access to the stream channel and banks can cause severe streambank erosion resulting in degraded water quality. Although they often make up a small percentage of grazing areas by surface area, riparian zones (vegetated stream corridors) are particularly attractive to cattle that prefer the cooler environment and lush vegetation found beside rivers and streams. This concentration of livestock can result in increased sedimentation of streams due to "hoof shear", trampling of bank vegetation, and entrenchment by the destabilized stream. Despite livestock's preference for frequent water access, farm veterinarians have reported that cows are healthier when stream access is limited (EPA, 1999).

Establishing, conserving and managing streamside vegetation (riparian buffer) is one of the most economical and efficient BMPs. Forested buffers in particular provide a variety of benefits including filtering runoff and taking up nutrients, moderating water temperature, preventing erosion and loss of land, providing flood control and helping to moderate streamflow, and providing food and habitat for both aquatic and terrestrial wildlife (NCDENR-DWQ, February 2002). To obtain a free copy of DWQ's *Buffers for Clean Water* brochure, call (919) 733-5083, ext. 558.

#### **4.4.3 Loss of Instream Organic Microhabitats**

Organic microhabitat (leafpacks, sticks and large wood) and edge habitat (root banks and undercut banks) play very important roles in a stream ecosystem. Organic matter in the form of leaves, sticks and other materials serve as the base of the food web for small streams. Additionally, these microhabitats serve as special niches for different species of benthic



macroinvertebrates, providing food and/or habitat. For example, many stoneflies are found almost exclusively in leafpacks and on small sticks. Some beetle species prefer edge habitat, such as undercut banks. If these microhabitat types are not present, there is no place for these specialized macroinvertebrates to live and feed. The absence of these microhabitats in some streams in the Lumber River basin is directly related to the absence of riparian vegetation (refer to Part 4.2.2 above). Organic microhabitats are critical to headwater streams, the health of which is linked to the health of the entire downstream watershed.

#### **4.4.4 Channelization**

Channelization refers to the physical alteration of naturally occurring stream and riverbeds. Typical modifications are described in the text box. Although increased flooding, bank erosion and channel instability often occur in downstream areas after channelization has occurred, flood control, reduced erosion, increased usable land area, greater navigability and more efficient drainage are frequently cited as the objectives of channelization projects (McGarvey, 1996).

Direct or immediate biological effects of channelization include injury and mortality of benthic macroinvertebrates, fish, shellfish/mussels and other wildlife populations, as well as habitat loss. Indirect biological effects include changes in benthic macroinvertebrate, fish and wildlife community structures, favoring species that are more tolerant of or better adapted to the altered habitat (McGarvey, 1996).

Restoration or recovery of channelized streams may occur through processes, both naturally and artificially induced. In general, streams that have not been excessively stressed by the channelization process can be expected to return to their original forms. However, streams that have been extensively altered may establish a new, artificial equilibrium (especially when the channelized streambed has been hardened). In such cases, the stream may enter a vicious cycle of erosion and continuous entrenchment. Once the benefits of a channelization project become outweighed by the costs, both in money and environmental integrity, channel restoration efforts are likely to be taken (McGarvey, 1996).

##### ***Typical Channel Modifications***

- Removal of any obstructions, natural or artificial, that inhibit a stream's capacity to convey water (clearing and snagging).
- Widening, deepening or straightening of the channel to maximize conveyance of water.
- Lining the bed or banks with rock or other resistant materials.

Channelization of streams within the continental United States is extensive and promises to become even more so as urban development continues. Overall estimates of lost or altered riparian habitats within US streams are as high as 70 percent. Unfortunately, the dynamic nature of stream ecosystems makes it difficult (if not impossible) to quantitatively predict the effects of channelization (McGarvey, 1996).

#### **4.4.5 Recommendations for Reducing Habitat Degradation**

In March 2002, the Environmental Management Commission (EMC) sent a letter to the Sedimentation Control Commission (SCC) expressing seven recommendations for improving erosion and sedimentation control, based on a comprehensive performance review of the

turbidity standard conducted in 2001 by DWQ staff. Specifically the recommendations are that the EMC and SCC:

1. Evaluate, in consultation with the Attorney General's Office, whether statutory authority is adequate to mandate temporary ground cover over a percentage of the uncovered area at a construction site within a specific time after the initial disturbance of the area. If it is found that statutory authority does not exist, then the EMC and SCC should prepare resolutions for the General Assembly supporting new legislation to this effect.
2. Prepare resolutions supporting new legislation to increase the maximum penalty allowed in the Sedimentation Pollution Control Act from \$5,000 to \$25,000 for the initial response to a noncompliant site.
3. Jointly support a review of the existing Erosion and Sediment Control Planning and Design Manual by DLR. This review should include, but not be limited to, a redesign of the minimum specifications for sedimentation basins.
4. Evaluate, in consultation with the Attorney General's Office, whether the statutory authority is adequate for effective use of the "Stop Work Order" tool and, if found not to be adequate, to prepare resolutions for the General Assembly supporting new legislation that will enable staff to more effectively use the "Stop Work Order" tool.
5. Support increased research into and experimentation with the use of polyacrylamides (PAMs) and other innovative soil stabilization and turbidity reduction techniques.
6. Jointly support and encourage the awarding of significant monetary penalties for all activities found to be in violation of their Stormwater Construction General Permit, their Erosion and Sediment Control Plan, or the turbidity standard.
7. Hold those individuals who cause serious degradation of the environment through excessive turbidity and sedimentation ultimately responsible for restoration of the area.

DWQ will continue to work cooperatively with DLR and local programs that administer sediment control in order to maximize the effectiveness of the programs and to take appropriate enforcement action when necessary to protect or restore water quality. However, more voluntary implementation of BMPs is needed for activities that are not subject to these rules in order to substantially reduce the amount of sedimentation.

Additionally, more public education is needed basinwide to educate landowners about the value of riparian vegetation along small tributaries and the impacts of sedimentation to aquatic life. Funding is available through numerous federal and state programs for landowners to restore and/or protect riparian buffer zones along fields or pastures, develop alternative watering sources for livestock, and fence animals out of streams (refer to Section C). EPA's *Catalog of Federal Funding Sources for Watershed Protection* (Document 841-B-99-003) outlines some of these and other programs aimed at protecting water quality. A copy may be obtained by calling the National Center for Environmental Publications and Information at (800) 490-9198 or by visiting the website at <http://www.epa.gov/OWOW/watershed/wacademy/fund.html>. Local contacts for various state and local agencies are listed in Appendix VI.

## **4.5 Fecal Coliform**

Fecal coliform bacteria live in the digestive tract of warm-blooded animals (humans as well as other mammals) and are excreted in their waste. Fecal coliform bacteria do not actually pose a

danger to people or animals. However, where fecal coliform are present, disease-causing bacteria may also be present and water that is polluted by human or animal waste can harbor other pathogens that may threaten human health.

The presence of disease-causing bacteria tends to affect humans more than aquatic creatures. High levels of fecal coliform bacteria can indicate high levels of sewage or animal wastes which could make water unsafe for human contact (swimming) or the harvesting and consumption of shellfish. Fecal coliform bacteria and other potential pathogens associated with waste from warm-blooded animals are not harmful to fish and aquatic insects. However, high levels of fecal coliform bacteria may indicate contamination that increases the risk of contact with harmful pathogens in surface waters. In the Lumber River basin, data from DWQ's ambient monitoring stations in subbasin 03-07-55 and 03-07-59 (Section B, Chapters 6 and 10) show high levels of fecal coliform bacteria. Many areas in the coastal region of the basin (subbasin 03-07-59) are Impaired because of shellfish harvesting area closures. There are also many waters that have high levels of fecal coliform bacteria associated mostly with stormwater runoff in urban areas. DWQ is currently developing TMDLs (see Appendix IV) for waters that are on the 303(d) list of Impaired waters.

Pathogens associated with fecal coliform bacteria can cause diarrhea, dysentery, cholera and typhoid fever in humans. Some pathogens can also cause infection in open wounds.

Under favorable conditions, fecal coliform bacteria can survive in bottom sediments for an extended period (Howell et al., 1996; Sherer et al., 1992; Schillinger and Gannon, 1985). Therefore, concentrations of bacteria measured in the water column can reflect both recent inputs as well as the resuspension of older inputs.

Reducing fecal coliform bacteria in wastewater requires a disinfection process, which typically involves the use of chlorine and other disinfectants. Although these materials may kill the fecal coliform bacteria and other pathogenic disease-causing bacteria, they also kill bacteria essential to the proper balance of the aquatic environment, and thereby, endanger the survival of species dependent on those bacteria.

Water quality standards for fecal coliform bacteria are intended to ensure safe use of waters for recreation and shellfish harvesting (refer to Administrative Code Section 15A NCAC 2B .0200). The North Carolina fecal coliform standard for freshwater is 200 colonies/100ml based on the geometric mean of at least five consecutive samples taken during a 30-day period and not to exceed 400 colonies/100ml in more than 20 percent of the samples during the same period. The 200 colonies/100ml standard is intended to ensure that waters are safe for water contact through recreation.

The standard for Class SA waters (waters used for shellfishing) is a median or geometric mean fecal coliform Most Probable Number (MPN) not greater than 14 MPN/100ml. In addition, not more than 10 percent of the samples can be in excess of 43 MPN/100ml. Many areas closed to shellfish harvesting have median levels below 14 MPN/100ml, but fail to meet the second criteria due to periodic contamination that occurs after moderate to heavy rainfall events.

### ***Sources of Fecal Coliform in Surface Waters***

- Urban stormwater
- Wild animals and domestic pets
- Improperly designed or managed animal waste facilities
- Livestock with direct access to streams
- Improperly treated discharges of domestic wastewater, including leaking or failing septic systems and straight pipes

The North Carolina Division of Environmental Health (DEH) has subdivided all of the state's coastal waters into shellfish growing areas in which a sanitary survey is conducted every three years. Beginning in the summer of 1997, DEH began assessing fecal coliform levels in coastal recreation waters. These assessments provide a gauge of water quality along the North Carolina coast over the short and long-term.

If a certain area along the coast is found to have potential water quality problems related to stormwater pipes or high levels of indicator bacteria, health officials will post signs recommending that people not swim there or harvest shellfish from the area. The location will be listed on the DEH website at

(<http://www.deh.enr.state.nc.us/shellfish/>), and local media and county health departments will be notified.

The state does not encourage swimming in surface waters since a number of factors which are beyond the control of any state regulatory agency contribute to elevated levels of disease-causing bacteria. To assure that waters are safe for swimming indicates a need to test waters for pathogenic bacteria. Although fecal coliform standards have been used to indicate the microbiological quality of surface waters for swimming and shellfish harvesting for more than 50 years, the value of this indicator is often questioned. Evidence collected during the past several decades suggests that the coliform group may not adequately indicate the presence of pathogenic viruses or parasites in water.

The detection and identification of specific pathogenic bacteria, viruses and parasites such as *Giardia*, *Cryptosporidium* and *Shigella* are expensive, and results are generally difficult to reproduce quantitatively. Also, to ensure the water is safe for swimming would require a whole suite of tests for many organisms, as the presence/absence of one organism would not document the presence/absence of another. This type of testing program is not possible due to resource constraints.

## **4.6 Water Quality Problems Resulting from Hurricanes**

### ***Current Status***

The Natural Resources Conservation Services' (NRCS) Emergency Watershed Protection (EWP) is responsible for emergency de-snagging (removal of piles of woody debris from stream and river channels) activities. The EWP program is intended to respond to watersheds impacted by natural disasters such as hurricanes, floods and fire. The purpose of the program is to restore watershed functions to predisaster conditions. Areas selected for debris removal are based on the amount and location of debris and the increased risk of flooding to improved property (including cropland) or public safety (primarily roads and bridges). Location maps and a description of all proposed work are sent to appropriate federal and state agencies for review and comment prior to contracting the work. The programs' intent is to consider environmental concerns.

The activity of debris removal is of great interest to DWQ as the excessive removal of debris can impact the aquatic habitat and aquatic life within a stream reach. The decision to remove debris is made considering topography, proximity of improved property subject to damage, location of culverts, bridges and other restrictions, comparison of costs and benefits, and potential environmental impacts. NRCS, along with other state and federal agencies, are in the process of developing guidelines for debris removal that will improve the decision-making process with regard to eligibility and damage thresholds, as well as improving the standards and specifications for removing woody debris in a manner that leaves enough to provide suitable habitat. Debris removal under EWP is not intended to remove all debris from stream channels, only that which causes or may cause an increased risk of flooding or streambank erosion.

Woody debris is the predominant habitat for benthic macroinvertebrates in larger, slower-moving coastal stream and wetland systems. Therefore, removal of these snags removes the habitat available for aquatic life. If care is not taken in properly removing woody debris, the streambanks and streambed can be altered as well as causing moderate to severe habitat degradation.

### 2003 Recommendations

DWQ is aware of the need to remove obstructions to water flow, including snags, near bridges or other structures in emergency situations because of safety concerns, to reduce economic loss in the event of natural disasters, and to reduce the risk of flooding. NRCS has recently adopted an Interagency Coordination and Implementation Plan for the EWP program that allows for a direct and ongoing role for several agencies to play in the implementation process. The method in which snags are removed, the amount of debris that is removed, and the sites selected should all be chosen following a thorough review by the various agencies responsible for the implementation of the EWP program. Local governments that receive additional funding for this type of activity should also implement the same management strategies as outlined in the EWP implementation plan to reduce impacts to water quality, aquatic habitat and aquatic life.

## **4.7 DWQ Stormwater Programs**

There are many different stormwater programs administered by DWQ. One or more of these programs affects many communities in the Lumber River basin. The goal of the DWQ stormwater discharge permitting regulations and programs is to prevent pollution from entering the waters of the state via stormwater runoff. Those programs try to accomplish this goal by controlling the source(s) of pollutants. These programs include NPDES Phase I and II, coastal county stormwater requirements, HQW/ORW stormwater requirements, and requirements associated with the Water Supply Watershed Program. Local governments that are or may be affected by these programs are presented in Table A-26.

### **4.7.1 NPDES Phase I**

Phase I of the EPA stormwater program started with Amendments to the Clean Water Act (CWA) in 1990. Phase I required NPDES permit coverage to address stormwater runoff from medium and large stormwater sewer systems serving populations of 100,000 or more people. Phase I also had requirements for ten categories of industrial sources to be covered under stormwater permits. Industrial activities which require permitting are defined in categories

ranging from sawmills and landfills to manufacturing plants and hazardous waste treatment, storage or disposal facilities. Construction sites disturbing greater than five acres are also required to obtain an NPDES stormwater permit under Phase I of the EPA stormwater program.

#### **4.7.2 NPDES Phase II**

##### Current Status

The Phase II stormwater program is an extension of the Phase I program that will include permit coverage for smaller municipalities and cover construction activities down to one acre. The local governments permitted under Phase II will be required to develop and implement a comprehensive stormwater management program that includes six minimum measures.

- 1) Public education and outreach on stormwater impacts.
- 2) Public involvement/participation.
- 3) Illicit discharge detection and elimination.
- 4) Construction site stormwater runoff control.
- 5) Post-construction stormwater management for new development and redevelopment.
- 6) Pollution prevention/good housekeeping for municipal operations.

Construction sites greater than one acre will also be required to obtain an NPDES stormwater permit under Phase II of the EPA stormwater program in addition to erosion and sedimentation control approvals.

Two counties (Table A-26) in the basin are automatically required (1990 and/or 2000 US Census designated Urbanized Areas) to obtain a NPDES stormwater permit under the Phase II rules if they own and operate a small MS4. The local governments designated based on the 1990 US Census, that own and operate a small MS4, are required to submit applications for NPDES stormwater permits by March 2003. Those designated based on the 2000 US Census have until May 2004 to submit applications. DWQ has developed criteria that will be used to determine whether other public entities should be required to obtain a NPDES permit and how the NPDES stormwater program will be implemented in North Carolina. The criteria are contained in temporary rule language (15A NCAC 2B .0126) that went into effect on November 1, 2002. DWQ is currently working on permanent state rules to implement the Phase II stormwater requirements. Also, the South Brunswick Water and Sewer Authority was issued a NPDES Phase II permit in 2001.

##### 2003 Recommendations

DWQ recommends that the local governments that will be permitted under Phase II proceed with permit applications and develop programs that can go beyond the six minimum measures. Implementation of Phase II as well as the other stormwater programs should help to reduce future impacts to streams in the basin. Local governments, to the extent possible, should identify sites for preservation or restoration. DWQ and other NCDENR agencies will continue to provide information on funding sources and technical assistance to support local government stormwater programs.

Table A-26 Communities in the Lumber River with Stormwater Requirements

	NPDES		Coastal Stormwater Rules	State Stormwater Program*	Water Supply Watershed Stormwater Requirements
Local Government	Phase I	Phase II*			
Municipalities					
Aberdeen					
Boiling Spring Lakes					
Chadbourn					
Fairmont					
Laurinburg					
Lumberton				X	X
Maxton					
Oak Island		X			
Pembroke					X
Pinehurst					X
Raeford					
Red Springs					
Saint Pauls					
Southern Pines					
Tabor City					
Whiteville					
Counties					
Bladen					
Brunswick		X	X	X	
Columbus				X	
Hoke		X		X	X
Moore				X	X
Montgomery					X
Richmond				X	X
Robeson				X	X
Scotland				X	X

Note: More local governments may be designated based on designation criteria set forth in state rule 15A NCAC 2B .0126.

\* Counties listed under State Stormwater Program do not pertain to the entire county, just those waters draining to HQWs and/or ORWs.

#### **4.7.3 State Stormwater Program and Coastal Stormwater Rules**

##### *Current Status*

The State Stormwater Management Program was established in the late 1980s under the authority of the North Carolina Environmental Management Commission (EMC) and North Carolina General Statute 143-214.7. This program, codified in 15A NCAC 2H .1000, affects development activities that require either an Erosion and Sediment Control Plan (for disturbances of one or more acres) or a Coastal Area Management Act (CAMA) major permit under the coastal stormwater rules within one of the 20 coastal counties and/or development draining to Outstanding Resource Waters (ORW) or High Quality Waters (HQW).

The State Stormwater Management Program requires developments to protect these sensitive waters by maintaining a low density of impervious surfaces, maintaining vegetative buffers, and transporting runoff through vegetative conveyances. Low density development thresholds vary from 12-30 percent built-upon area (impervious surface) depending on the classification of the receiving stream. If low density design criteria cannot be met, then high density development requires the installation of structural best management practices (BMPs) to collect and treat stormwater runoff from the project. High density BMPs must control the runoff from the 1 or 1.5-inch storm event (depending on the receiving stream classification) and remove 85 percent of the total suspended solids.

Table A-26 shows the one coastal county, Brunswick County, in the Lumber River basin where permits may be required under the stormwater management program and the coastal stormwater rules under CAMA or ORW stormwater rules. Several other counties are depicted in Table A-26 which may be required to obtain permits under the state stormwater rules where development activities drain to HQW or ORW waters. Note, however, this does not pertain to the entire county, just the waters in the county which drain to HQWs and/or ORWs. Also, all development requiring an Erosion and Sediment Control Plan (for disturbances of one or more acres) must obtain a stormwater permit.

##### *2003 Recommendations*

DWQ will continue implementing the state stormwater program with the other NCDENR agencies and local governments. Local governments should develop local land use plans that minimize impervious surfaces in sensitive areas. Communities should integrate state stormwater program requirements, to the extent possible, with other stormwater programs in order to be more efficient and gain the most water quality benefits for protection of public health and aquatic life.

#### **4.7.4 Water Supply Watershed Stormwater Rules**

##### *Current Status*

The purpose of the Water Supply Watershed Protection Program is to provide a proactive drinking water supply protection program for communities. Local governments administer the program based on state minimum requirements. There are restrictions on wastewater discharges, development, landfills and residual application sites to control the impacts of point and nonpoint sources of pollution. The program attempts to minimize the impacts of stormwater runoff by utilizing low density development or stormwater treatment in high density areas.



All local governments in the Lumber River basin that have jurisdiction within a water supply watershed have an EMC approved water supply watershed protection ordinance. Refer to page 39 for more information on classified water supply waters and watersheds in the Lumber River basin. Table A-26 shows a listing of local governments that have approved water supply ordinances.

#### 2003 Recommendations

DWQ recommends continued implementation of local water supply protection ordinances to ensure safe and economical treatment of drinking water. Communities should also integrate water supply protection ordinances with other stormwater programs, to the extent possible, in order to be more efficient and gain the most water quality benefits for both drinking water and aquatic life.

### **4.8 Protection and Restoration of Streams in Urbanized and Developing Watersheds**

#### **4.8.1 Current Status**

Urbanization often has greater hydrologic effects than any other land use, as native vegetation is replaced with impervious surfaces in the form of paved roads, buildings, parking lots, and residential homes and driveways. Urbanization results in increased surface runoff and correspondingly earlier and higher peak flows after storms. Flooding frequency is also increased. These effects are compounded when small streams are channelized (straightened) or piped and storm sewer systems are installed to increase transport of drainage waters downstream. Bank scour from these frequent high flow events tends to enlarge streams and increases suspended sediment. Scouring also destroys the variety of habitat in streams leading to degradation of benthic macroinvertebrate populations and loss of fisheries (EPA, 1999). Most of the impacts are in terms of habitat degradation (page 62), but runoff from developed and developing areas can also carry toxic pollutants and pathogens to surface waters (NCDENR-DWQ, November 2001). For these streams to support aquatic life, good water quality and aquatic habitat must be maintained.

Currently, in the Lumber River basin in subbasin 03-07-59, there are 3,606.9 estuarine acres (Class SA) that are Impaired due to the loss of shellfish harvesting where stormwater runoff is a contributing factor. These waters around the high growth areas of the basin are, and will increasingly be, impacted by urban stormwater runoff as land use changes from agriculture and forest uses to urban and suburban land uses.

#### **4.8.2 2003 Recommendations**

##### Maintain Riparian Buffers

The presence of intact riparian buffers and/or wetlands in urban areas can lessen these impacts, and restoration of these watershed features should be considered where feasible; however, the amount of impervious cover should be limited as much as possible. Wide streets, huge cul-de-sacs, long driveways and sidewalks lining both sides of the street are all features of urban development that create excess impervious cover and consume natural areas.

Removing trees, shrubs and other vegetation to plant grass or place rock (also known as riprap) along the bank of a river or stream degrades water quality. Removing riparian vegetation eliminates habitat for aquatic macroinvertebrates that are food for trout and other fish. Rocks lining a bank absorb the sun's heat and warm the water. Some fish require cooler water temperatures as well as the higher levels of dissolved oxygen cooler water provides. Trees, shrubs and other native vegetation cool the water by shading it. Straightening a stream, clearing streambank vegetation, and lining the banks with grass or rock severely impact the habitat that aquatic insects and fish need to survive (WNCT, 1999).

Preserving the natural streamside vegetation (riparian buffer) is one of the most economical and efficient BMPs. Forested buffers in particular provide a variety of benefits including filtering runoff and taking up nutrients, moderating water temperature, preventing erosion and loss of land, providing flood control and helping to moderate streamflow, and providing food and habitat for both aquatic and terrestrial wildlife. To obtain a free copy of DWQ's *Buffers for Clean Water* brochure, call (919) 733-5083, ext. 558.

### Protect Headwater Streams

Many streams in a given river basin are only small trickles of water that emerge from the ground. A larger stream is formed at the confluence of these trickles. This constant merging eventually forms a large stream or river. Most monitoring of fresh surface waters evaluates these larger streams. The many miles of small trickles, collectively known as headwaters, are not directly monitored and in many instances are not even indicated on maps. However, impairment of headwater streams can (and does) impact the larger stream or river.

Headwater areas are found from the mountains to the coast along all river systems and drain all of the land in a river basin. Because of the small size of headwater streams, they are often overlooked during land use activities that impact water quality. All landowners can participate in the protection of headwaters by keeping small tributaries in mind when making land use management decisions on the areas they control. This includes activities such as retaining vegetated stream buffers and excluding cattle from streams. Local rural and urban planning initiatives should also consider impacts to headwater streams when land is being developed.

For a more detailed description of watershed hydrology, please refer to EPA's Watershed Academy website: <http://www.epa.gov/OWOW/watershed/wacademy/acad2000/watershedmgt/principle1.html>.

### Reduce Impacts of Future Development

Areas adjacent to the high growth areas of the basin are at risk of having impaired biological communities. These biological communities are important to maintaining the ecological integrity in the Lumber River basin. These streams will be important as sources of benthic macroinvertebrates and fishes for reestablishment of biological communities in nearby streams that are recovering from past impacts or are being restored.

Proactive planning efforts at the local level are needed to assure that development is done in a manner that minimizes impacts to water quality. These planning efforts must find a balance among water quality protection, natural resource management and economic growth. Growth management requires planning for the needs of future population increases as well as developing

and enforcing environmental protection measures. These actions are critical to water quality management and the quality of life for the residents of the basin.

Action should be taken at the local level to plan for new development in urban and rural areas. For more detailed information regarding recommendations for new development found in the text box (below), refer to EPA's website at [www.epa.gov/owow/watershed/wacademy/acad2000/protection](http://www.epa.gov/owow/watershed/wacademy/acad2000/protection) and the Center for Watershed Protection website at [www.cwp.org](http://www.cwp.org). Additional public education is also needed in the Lumber River basin in order for citizens to understand the value of urban planning and stormwater management. DWQ recently developed a booklet that discusses actions individuals can take to reduce stormwater runoff and improve stormwater quality entitled *Improving Water Quality In Your Own Backyard*. To obtain a free copy, call (919) 733-5083, ext. 558.

To prevent further impairment to aquatic life in streams in urbanizing watersheds local governments should:

1. Identify waters that are threatened by development.
2. Protect streams beyond existing buffer regulations.
3. Implement stormwater BMPs during and after development.
4. Develop land use plans that minimize disturbance in sensitive areas of watersheds.
5. Minimize impervious surfaces including roads and parking lots.
6. Develop public outreach programs to educate citizens about stormwater runoff.

#### *Establish Long-Term Restoration Plans for Impaired Streams*

Many streams in existing urban areas have been Impaired for a very long time. Because of the large amounts of established structures, it is generally considered to be too expensive to undertake a stream restoration project in many urban watersheds. These streams are important to ecosystem health, water quality in the basin, and to the quality of life in general. The following steps can be incorporated into a long-term redevelopment plan that will eventually provide opportunity for a stream restoration project.

1. Maintain good water quality and aquatic habitat of nearby unimpacted watersheds. Streams in these watersheds will be needed to establish reference conditions and as a source of aquatic life for repopulating restored streams.
2. Identify urban watersheds and encourage community groups, local business and industry to become involved in the long-term planning, fund raising and eventual restoration projects.
3. Target streamside properties that can be purchased or put into easement as the existing structures are removed to provide space for restoration of riparian areas.
4. When streamside properties are redeveloped, structures and parking lots should be sited to provide as much space as possible for restoration of stream channels and riparian areas.

#### ***Planning Recommendations for New Development***

- Minimize number and width of residential streets.
- Minimize size of parking areas (angled parking and narrower slots).
- Place sidewalks on only one side of residential streets.
- Vegetate road right-of-ways, parking lot islands and highway dividers to increase infiltration.
- Plant and protect natural buffer zones along streams and tributaries.
- Minimize floodplain development.
- Protect and restore wetland/bog areas.

5. Minimize impervious surfaces during redevelopment with the goal of having less impervious surface than was previously on the site.
6. Install BMPs that can hold and treat stormwater runoff from the site during and after redevelopment.
7. When enough stream reach has restoration opportunity, proceed with restoration projects.
8. Proactive planning efforts through local land use plans, refer to Section C, Part 1.3.

Although this process may take many years before urban stream water quality and aquatic habitat are restored, the end product will be an important feature of urban areas.

## **4.9 Capacity Use Investigation**

### *Current Status*

A capacity use area investigation occurs at the request of the Environmental Management Commission (EMC) under the guidance of the Water Use Act of 1967 (G.S. 143-215.11). The EMC can request an investigation to determine whether rules for capacity use area designation and procedures for water use permitting should be written. Under G.S. 143-215.13(b) a capacity use area can be defined if the EMC finds that the combined uses of water have exceeded or threaten to exceed availability.

Of special concern in the Lumber River basin are the declining groundwater levels in the upper Cape Fear aquifer centered under the Smithfield Packing, Inc. plant in Bladen County and extending into Cumberland and Robeson counties. This aquifer supplies the bulk of the drinking and industrial groundwater needs in this region. Elizabethtown, Bladen County water districts, White Lake, Bladenboro and other small towns make use of this resource. Groundwater levels have declined to the top of the aquifer under Smithfield Packing plant; dewatering of the upper Cape Fear aquifer is already occurring or will occur in the near future. Also, these withdrawals may cause lateral or vertical saltwater encroachment.

### *2003 Recommendations*

In the fall of 2002, the Environmental Management Commission (EMC) requested the Division of Water Resources (DWR) to submit a report entitled "Proposed Bladen County Capacity Use Investigation Scope of Work and Timeline for Completion" to the Water Allocation Committee (WAC). The DWR presented the report to the WAC on December 11, 2002. The WAC recommended that DWR perform a capacity use investigation and report on the results in 18 months. The EMC approved the recommendation of the WAC on December 12, 2002.

## **4.10 Impacted Streams in Agricultural Areas**

### *Current Status*

Impacts to streams from agricultural activities can include excessive nutrient loading, pesticide and herbicide contamination, bacterial contamination and sedimentation. In the coastal plain, many agricultural areas are ditched, thereby, increasing the delivery of the contaminants to surface waters.

There are stream miles that are being impacted in areas where agriculture is the predominant land use, and biologists have noted these impacts to streams related to nutrient loading and sedimentation. There has been a loss of approximately 41,000 acres of cultivated cropland in the Lumber River basin since 1982 (page 18). Much of this land has been converted into more intensive uses such as urban and suburban areas.

#### 2003 Recommendations

DWQ will identify streams where agricultural land use may be impacting water quality and aquatic habitat. This information will be related to local Division of Soil and Water Conservation (DSWC) and NRCS staff to investigate the agricultural impacts in these watersheds and to recommend BMPs to reduce impacts. DWQ recommends that funding and technical support for agricultural BMPs be continued. Refer to Appendix VI for agricultural nonpoint source agency contact information.

### **4.11 Confined Animal Operations**

Waste produced by confined animal operations in North Carolina is a valuable soil amendment and source of nitrogen, phosphorus and other crop nutrients, when applied to land in proper amounts (the traditional waste management approach). But, if not properly used or disposed, or if applied in amounts that exceed plant needs, animal waste can leach through soil to contaminate groundwater or can be transported by runoff to pollute rivers and streams.

DWQ recommends that the agricultural community work to implement best management practices and/or other alternatives to avoid excessive land application.

### **4.12 Addressing Waters on the State's 2002 Integrated 305(b) and 303(d) Report**

#### Current Status

Section 303(d) of the federal Clean Water Act requires states to develop a 303(d) list of waters not meeting water quality standards or which have Impaired uses. States are also required to develop Total Maximum Daily Loads (TMDLs) or management strategies for 303(d) listed waters to address impairment. In the last few years, the TMDL program has received a great deal of attention as the result of a number of lawsuits filed across the country against EPA. These lawsuits argue that TMDLs have not been developed by states or the EPA. As a result of these lawsuits, EPA issued a guidance memorandum in August 1997 that called for states to develop schedules for developing TMDLs for all waters on the 303(d) list. The schedules for TMDL development, according to this EPA memo, are to span 8-13 years.

In 2002, per EPA guidance, DWQ submitted required information on a format similar to that specified in the *2002 Integrated Water Quality Monitoring and Assessment Report* (EPA, 2001b). This integrated report is considered a hybrid report, incorporating elements of old and new EPA guidance on 305(b) and 303(d) reporting. EPA confirms this report satisfies Clean Water Act (CWA) requirements for both the 2002 Section 305(b) water quality report and the 2002 Section 303(d) priority ranking of Impaired waterbodies, commonly referred to as the Section 303(d) list.

The rigorous and demanding task of developing TMDLs for each of these waters during an 8 to 13-year time frame will require the focus of much of the water quality program's resources. Therefore, it will be a priority for North Carolina's water quality programs over the next several years to develop TMDLs for 303(d) listed waters.

#### 2003 Recommendations

For the next several years, addressing water quality impairment in waters that are on the state's 303(d) list will be a priority. The waters in the Lumber River basin that are on this list are presented in the individual subbasin descriptions in Section B and in Section A, Chapter 3, Table A-25. For information on listing requirements and approaches, refer to Appendix IV.

### **4.13 Golf Courses**

There were 17,108 golf courses in the United States in 2000; and in that year, 524 new courses were built, 707 were under construction, and 1,049 were being planned (NGF, 2001). In North Carolina, 150,000 acres of new turf areas, including athletic fields, recreational areas, home lawns and golf courses, are developed each year and the rate of development continues to grow (NCCES, 1995). Without proper site design, construction practices and maintenance, all turf areas can serve as a source of sediment, nutrients and other contaminants that can impact water quality. Golf courses, because of their size, location and historical design practices, can cause significant impacts to small streams. In order to insure water quality protection, best management practices (BMPs) that maximize resources while minimizing risk to the environment should be implemented throughout the life of a golf course from design to construction to daily maintenance.

Proper site design works with the landscape. The design should designate environmentally sensitive areas throughout the course and strive to protect them with minimal disturbance. The design can prevent or minimize erosion and stormwater runoff by maintaining natural vegetated riparian areas near streams, wetlands and lake shorelines as much as possible. Good design also minimizes the development of gullies, avoids channelization (straightening) of streams, and prohibits the unnecessary disruption of streambanks and lake shorelines (NCCES, 1995).

During golf course construction, the exposed soils and steep slopes are highly susceptible to erosion thus sedimentation to any adjacent streams. North Carolina requires that an erosion and sediment control plan be submitted to the Land Quality Section, Division of Land Resources, 30 days prior to the start of clearing or grading for areas larger than one contiguous acre. In order to reduce erosion and sedimentation from the site, strategies to effectively control sediment by minimizing the loss of topsoil and protecting water resources should be implemented throughout the construction of the course (CRM, 1996). Establishing ground cover as soon as possible after soil disturbance is one very effective BMP to implement during construction activity (NCCES, 1995).

Maintenance of the golf course also has the potential to impact water quality through improper fertilization, mowing and irrigation. Fertilizer applications should be based on a soil test to determine the appropriate timing, level and type of fertilizer necessary for the type of grass on particular areas of the course. Fertilizers should also not be applied on the steep slopes near surface waters or directly to lakes, streams and drainage areas. It is a good practice to maintain a

buffer of low-maintenance grasses or natural vegetation between areas of the highly maintained portions of the golf course and surface waters (NCCES, 1995).

The appropriate level of irrigation for a golf course is vital to the health of the grasses and the preservation of water quality. Over-irrigating increases the potential for leaching fertilizers, pesticides and nutrients from the soil and increasing runoff. A properly designed irrigation system will apply a uniform level of water at the desired rate and time. The amount and frequency of watering should be based on the type of grass and soil and weather conditions (NCCES, 1995).

Golfers can also play a role in protecting water quality on the golf course. Players should respect designated environmentally sensitive areas within the course and recognize that golf courses are managed areas that complement the natural environment. Golfers should also support and encourage maintenance practices that protect and enhance the environment and encourage the development of environmental conservation plans for the course. In addition, golfers can choose to patronize courses that are designed, constructed and maintained with protection of natural resources in mind (CRM, 1996).





# **Section B**

## **Water Quality Data and Information by Subbasin**



# Section B - Chapter 1

## Lumber River Subbasin 03-07-50

### Drowning Creek and Naked Creek

## 1.1 Subbasin Overview

### ***Subbasin 03-07-50 at a Glance***

#### **Land and Water Area**

Total area:	325 mi <sup>2</sup>
Land area:	324 mi <sup>2</sup>
Water area:	1 mi <sup>2</sup>

#### **Population**

2000 Est. Pop.:	31,681 people
-----------------	---------------

#### **Land Cover (percent)**

Forest/Wetland:	80
Surface Water:	1
Urban:	1
Agriculture:	18

#### **Counties**

Hoke, Montgomery, Moore,  
Richmond and Scotland

#### **Municipalities**

Aberdeen, Candor, Foxfire Village,  
Hoffman, Norman, Pinebluff,  
Pinehurst and Southern Pines

The headwaters of the Lumber River are located in this subbasin and contain the drainage of Drowning and Naked Creeks and their tributaries. Since this subbasin lies entirely in the Sandhills ecoregion, it reflects high water quality from both sandy soil characteristics (which promote groundwater infiltration) and undisturbed forested land use. Additionally, Naked Creek (from source to Drowning Creek) and Rocky Ford Branch (from source to Naked Creek) are designated ORW (page 36).

Population growth in this subbasin is concentrated around Southern Pines, Pinehurst and Aberdeen. Pinehurst is the most rapidly growing municipality in the basin (population: 9,706). Hoke County will be required to develop a stormwater program under Phase II (see page 69 for more information on state stormwater programs). Hoke and Moore counties have rapid growth increases projected for 2020 (refer to Table A-5 in Section A). There are four NPDES wastewater discharge permits in this subbasin. The largest is Moore County WWTP which discharges 6.7 MGD to Aberdeen Creek. Refer to Appendix I for identification and more information on NPDES permit holders. There are also 10 registered

swine operations in this subbasin (see page 23 for more information regarding animal operations).

Benthic macroinvertebrate community data were collected from four sites. Two of the sites remained at the same Excellent bioclassification while the other two lowered to a Good bioclassification. Two additional benthic macroinvertebrate sites were also sampled as part of a special study investigation. There were eight fish community sites sampled as part of basinwide monitoring in 2001. Six sites were monitored for the first time. All of the fish community sites were Not Rated, as biocriteria are being developed (page 57). Four of the fish community sites were part of a special studies collection. Lakes assessment was conducted on Pages Lake and was determined to be mesotrophic from the 2001 basinwide sampling. The only ambient monitoring station is located on Drowning Creek near Hoffman. Monitoring data from this location reflect conditions in the upper reaches of Drowning Creek, including the entire Naked and Horse Creeks. There were no parameter exceedances observed from this station during the assessment period (1996-2001). Figure B-1 shows locations of all biological/chemical monitoring sites and use support ratings.

Figure B-1 Lumber River Subbasin 03-07-50

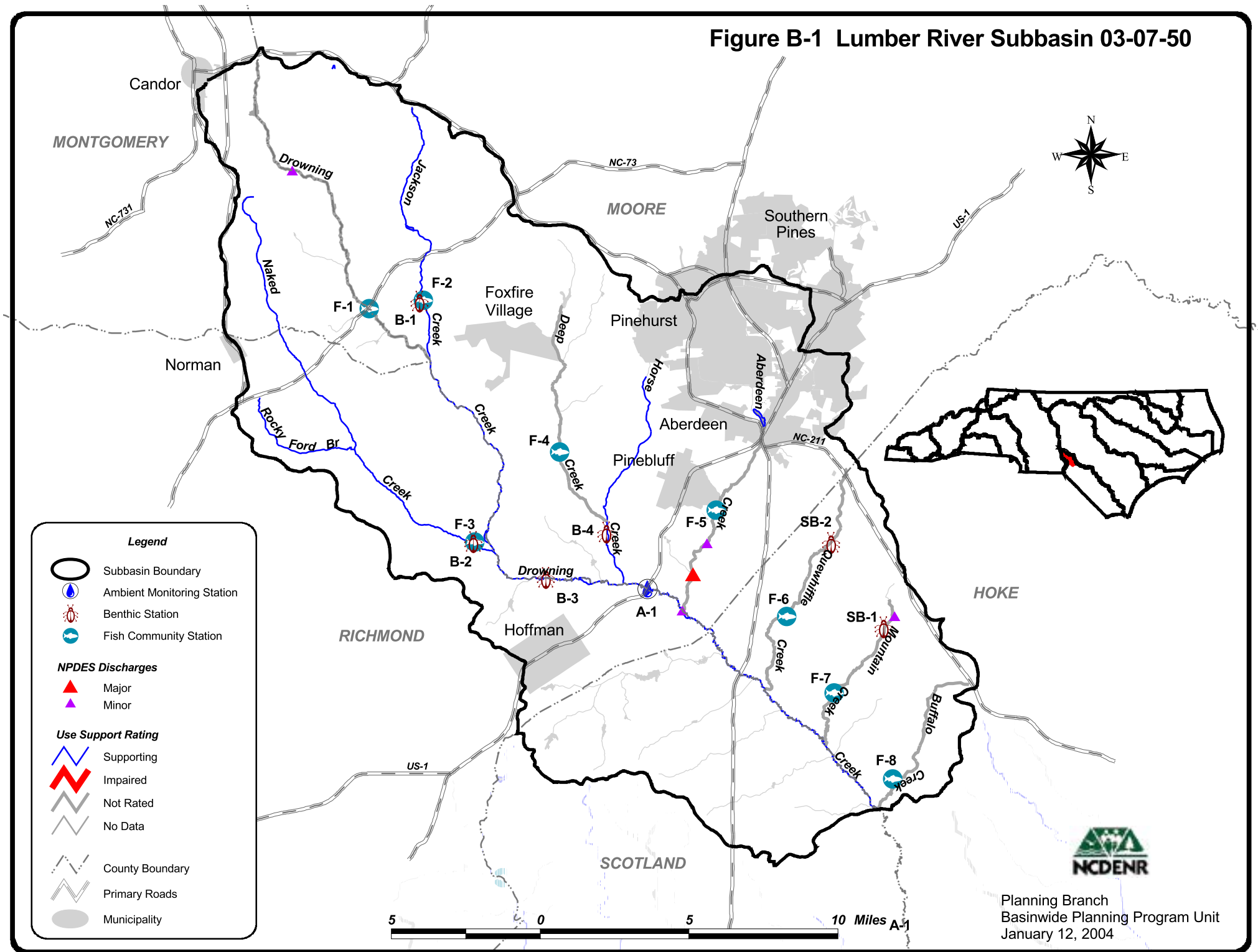


Table B-1 DWQ Monitoring Locations, Bioclassifications and Notable Chemical Parameters (1996-2001) for Subbasin 03-07-50

<b>Benthic Macroinvertebrate Community Monitoring Sites</b>					
<b>Site <sup>1</sup></b>	<b>Waterbody</b>	<b>County</b>	<b>Location</b>	<b>1996</b>	<b>2001</b>
B-1	Jackson Creek <sup>2</sup>	Moore	SR 1122	Excellent	Good
B-2	Naked Creek <sup>2</sup>	Richmond	SR1003	Excellent	Excellent
B-3	Drowning Creek <sup>2</sup>	Richmond	SR 1004	Excellent	Excellent
B-4	Horse Creek <sup>2</sup>	Moore	SR 1102	Excellent	Good
SB-1	Mountain Creek <sup>2</sup>	Hoke	SR 1215	--	Not Rated (1998)
SB-2	Quewhiffle Creek <sup>2</sup>	Hoke	SR 1214	--	Not Rated
<b>Fish Community Monitoring Sites</b>					
<b>Site <sup>1</sup></b>	<b>Waterbody</b>	<b>County</b>	<b>Location</b>	<b>1996</b>	<b>2001</b>
F-1	Drowning Creek <sup>2</sup>	Moore	NC 73	Not Rated	Not Rated
F-2	Jackson Creek	Moore	SR 1122	--	Not Rated
F-3	Naked Creek <sup>2</sup>	Richmond	SR 1003	Not Rated	Not Rated
F-4	Deep Creek	Moore	SR 1113	--	Not Rated
F-5	Aberdeen Creek	Moore	SR 1105	--	Not Rated
F-6	Quewhiffle Creek	Hoke	SR 1225	--	Not Rated
F-7	Mountain Creek	Hoke	SR 1215	--	Not Rated
F-8	Buffalo Creek	Hoke	SR 1203	--	Not Rated
<b>Ambient Monitoring Sites</b>					
<b>Site<sup>1</sup></b>	<b>Waterbody</b>	<b>County</b>	<b>Location</b>	<b>Station #</b>	<b>Noted Parameters<sup>3</sup></b>
A-1	Drowning Creek	Richmond	US 1	I2090000	None

<sup>1</sup> B = benthic macroinvertebrates; F = fish community; A = ambient monitoring station; and SB = benthic macroinvertebrates special study site.

<sup>2</sup> Historical data available at this site. Refer to Appendix II.

<sup>3</sup> Parameters are noted if in excess of state standards in greater than 10 percent of all samples.

Table B-1 contains a summary of monitoring data types, locations and results. Refer to the 2002 *Lumber River Basinwide Assessment Report* at <http://www.esb.enr.state.nc.us/bar.html> and Section A, Chapter 3 for more information on monitoring.

Use support ratings are summarized in Part 1.2 below. Recommendations, current status and future recommendations for waters that were Impaired in 1999 and newly Impaired waters are discussed in Part 1.3 below. Supporting waters with noted water quality impacts are discussed in Part 1.4 below. Water quality issues related to the entire subbasin are discussed in Part 1.5. Refer to Appendix III for use support methods and more information on all monitored waters.

## 1.2 Use Support Summary

Use support ratings (page 47) in subbasin 03-07-50 were assigned for aquatic life, fish consumption, recreation and water supply categories. All waters in the subbasin are considered Impaired on an evaluated basis because of a fish consumption advice (page 59). All water supply waters are Supporting on an evaluated basis based on reports from DEH regional water treatment plant consultants. Refer to Table B-2 for a summary of use support ratings by category for waters in the subbasin.

Table B-2 Summary of Use Support Ratings by Use Support Category in Subbasin 03-07-50

Use Support Rating	Basis	Aquatic Life	Fish Consumption	Recreation	Water Supply
Supporting	Monitored	62.0 mi 35.2 ac	0	15.7 mi	0 mi 0 ac
	All Waters	66.2 mi 35.2 ac	0	15.7 mi	93.6 mi 0 ac
Impaired	Monitored	0	0	0	0
	All Waters	0	180.7 mi 114.0 ac	0	0
Not Rated	Monitored	50.9 mi	0	0	0
No Data	N/A (No Data)	63.6 mi 78.8 ac	0	165.0 mi 114.0 ac	0
Total	Monitored	112.8 mi 35.2 ac		15.7 mi 0 ac	0
	All Waters	180.7 mi 114.0 ac	180.7 mi 114.0 ac	180.7 mi 114.0 ac	93.6 mi 0 ac
	Percent Monitored	62.4% mi 30.9% ac	0%	8.7% mi 0% ac	0%

Note: All waters include monitored, evaluated and waters that were not assessed.

## 1.3 Status and Recommendations of Previously and Newly Impaired Waters

There were no Impaired streams identified in the 1999 Lumber River Basinwide Water Quality Plan in this subbasin. All waters in the subbasin are considered Impaired on an evaluated basis because of a fish consumption advice (page 59). There are no other newly Impaired waters in subbasin 03-07-50. Refer to Part 1.4 below for information on waters with noted water quality impacts.

## 1.4 Status and Recommendations for Waters with Noted Impacts

The surface waters discussed in this section are not Impaired. However, notable water quality problems and concerns have been documented for some waters based on this assessment.

Attention and resources should be focused on these waters to prevent additional degradation or facilitate water quality improvement.

Waters in the following section are identified by assessment unit number (AU#). This number is used to track defined segments in the water quality assessment database and the 303(d) Impaired waters list. The assessment unit number is a subset of the DWQ index number (classification identification number). A letter attached to the end of the AU# indicates that the assessment is smaller than the DWQ index segment. No letter indicates that the assessment unit and the DWQ index segment are the same.

#### **1.4.1 Drowning Creek, SR 1004 [AU# 14-2-(6.5)]**

##### *Current Status*

Drowning Creek at SR 1004 is currently Supporting based on an Excellent bioclassification at site B-3 with very diverse instream habitat. However, notable bank erosion was observed during the 1996 and 2001 investigations. Refer to page 62 for more information regarding habitat degradation.

##### *Current Water Quality Initiatives*

In 2000, Sandhills Area Land Trust prepared a riparian corridor conservation design for the Conservation Trust for North Carolina and the Clean Water Management Trust Fund (CWMTF). The goal of the design is to protect existing riparian buffers as wide as the wetlands associated with Drowning Creek and its tributaries, plus an additional 100-300 feet depending on the topography and other local conditions.

As of December 2002, the Sandhills Area Land Trust received \$600,250 in grants from the CWMTF to acquire over 671 acres for permanent conservation easements along Drowning, Naked and Deep Creeks and other tributaries. See page 152 for project descriptions.

### **1.5 Additional Water Quality Issues within Subbasin 03-07-50**

This section discusses issues that may threaten water quality in the subbasin that are not specific to particular streams, lakes or reservoirs. The issues discussed may be related to waters near certain land use activities or within proximity to different pollution sources.

#### **1.5.1 Water Quality Threats to Streams in Urbanizing Watersheds**

Even though the streams in this subbasin are not already Impaired from urban stormwater runoff, they are threatened throughout by development pressure. In order to prevent aquatic habitat degradation and impaired biological communities, protection measures should be put in place immediately. Refer to page 73 for a description of urban stream water quality problems and recommendations for reducing impacts and restoring water quality.

### **1.5.2 Water Supply Watersheds (Drowning Creek, Horse Creek, Deep Creek, Jackson Creek)**

Over half of the total stream miles (51.8 percent) in this subbasin are classified as water supply watersheds (WS-II). By definition, these waters are also classified as HQW because requirements for this level of water supply protection are at least as stringent as those for HQWs. In addition, Naked Creek and Rocky Ford Branch are designated ORWs. See page 36 for more information regarding surface water classifications. Local governments having jurisdiction within the water supply watersheds are encouraged to implement a more protective local water supply watershed ordinance than the state's minimal requirements. For example, a more protective land use ordinance could require a wider natural, undisturbed riparian buffer. Local governments are also encouraged to retain these WS-II classifications. This will continue further protection for the water supply watersheds. See page 39 for more information regarding this issue.

### **1.5.3 Golf Courses**

The number of golf courses in this subbasin is significant, making many of the small towns centers of golfing activity. Utilizing best management practices during and after construction of the courses can greatly reduce nonpoint source pollution to adjacent streams. It is critical to implement and maintain these management practices throughout the life of the golf course. See page 78 for more information.



## Section B - Chapter 2

### Lumber River Subbasin 03-07-51

#### Lumber River

## 2.1 Subbasin Overview

### ***Subbasin 03-07-51 at a Glance***

#### **Land and Water Area**

Total area:	476 mi <sup>2</sup>
Land area:	470 mi <sup>2</sup>
Water area:	6 mi <sup>2</sup>

#### **Population Statistics**

2000 Est. Pop.: 48,514 people

#### **Land Cover (percent)**

Forest/Wetland:	57
Surface Water:	1
Urban:	1
Agriculture:	41

#### **Counties**

Columbus, Hoke, Robeson and Scotland

#### **Municipalities**

Boardman, Cerro Gordo, Chadbourn, Fair Bluff, Lumberton, Maxton, Orrum, Pembroke and Wagram

The Lumber River mainstem and its tributaries are located in this subbasin. Although the headwaters are within the Sandhills ecoregion, the Lumber River below Lumberton lies in the Coastal Plain ecoregion. Here the Lumber River is typical of a coastal plain system, wider and deeper, although a fast flow is maintained. The tributaries are swamp streams and usually have very little flow during the summer months.

There are 7,937 acres of managed public lands in this subbasin as the Lumber River State Park. A total of 115 miles of the Lumber River is of State Natural and Scenic Water designation and 81 miles have also been designated as a National Wild and Scenic Water.

The Lumber River mainstem flows through the largest urbanized area, Lumberton, in the middle portion of the subbasin (population: 20,795).

There are 14 NPDES wastewater discharge permits in this subbasin with a permitted flow of 46 MGD. The largest is Lumberton WWTP discharging to the Lumber River at 10 MGD. There is also one individual NPDES stormwater permit in the subbasin. Refer to Appendix I for

identification and more information on individual NPDES permit holders. Hoke County will be required to develop a stormwater program under Phase II (page 69). Hoke County's estimated population change is 24,245 for the 2000-2020 year projection (see Table A-5 in Section A for more details). There are also 16 registered swine operations in this subbasin (see page 23 for more information regarding animal operations).

There were 11 benthic macroinvertebrate community sites sampled in 2001 as part of the basinwide monitoring. One of the benthic sites improved and eight sites remained at the same bioclassification. Two benthic sites were monitored for the first time. The six fish community sites were Not Rated, as biocriteria are being developed (page 57). Four of the fish community sites were part of a special study. Fish tissue samples were collected from a site on the Lumber River mainstem near Boardman. Data were collected from seven ambient monitoring stations as well (Figure B-2 and Table B-3). Refer to the *2002 Lumber River Basinwide Assessment Report* at <http://www.esb.enr.state.nc.us/bar.html> and Section A, Chapter 3 for more information on monitoring.

Figure B-2 Lumber River Subbasin 03-07-51

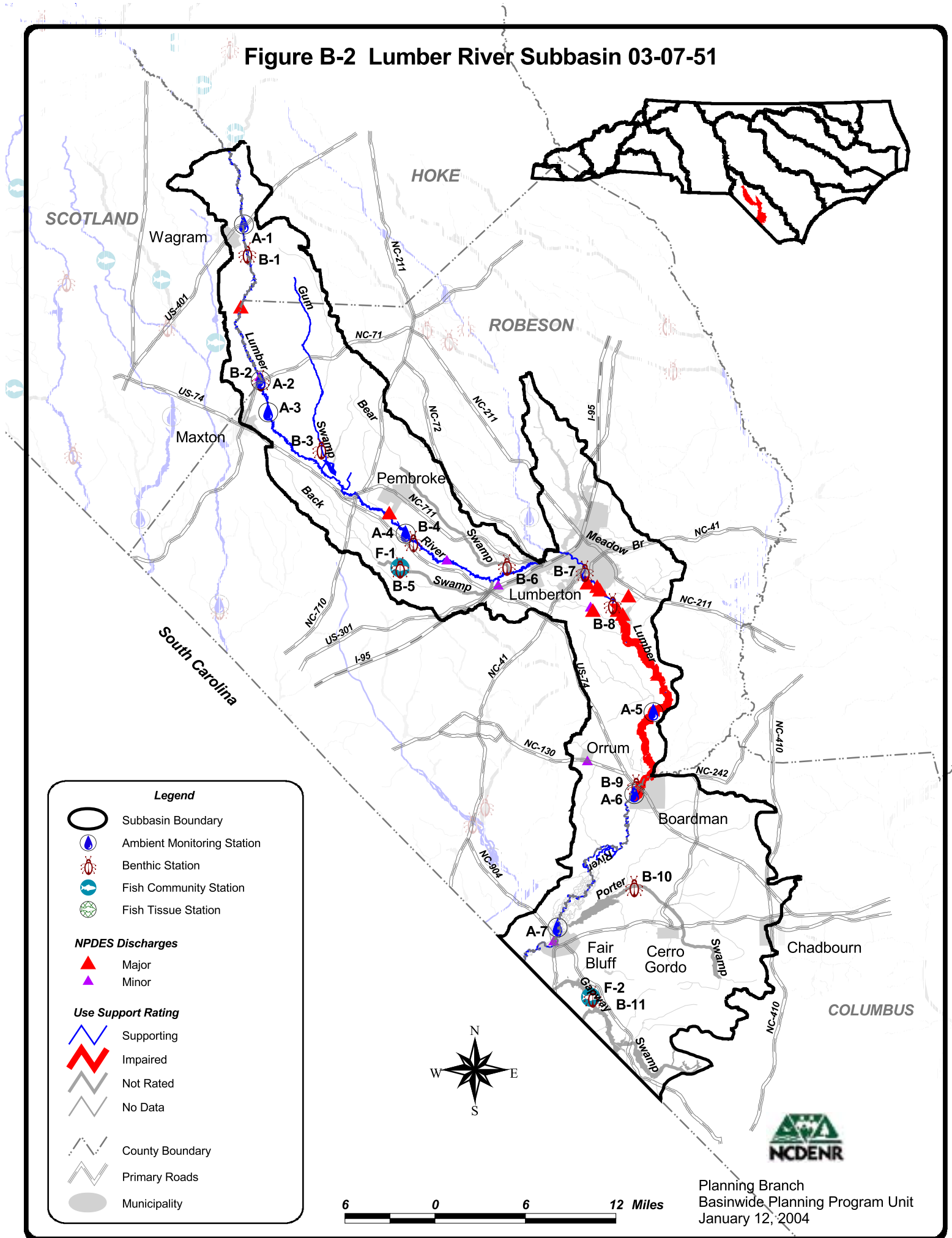


Table B-3 DWQ Monitoring Locations, Bioclassifications and Notable Chemical Parameters (1996-2001) for Subbasin 03-07-51

<b>Benthic Macroinvertebrate Community Monitoring Sites</b>					
<b>Site<sup>1</sup></b>	<b>Waterbody</b>	<b>County</b>	<b>Location</b>	<b>1996</b>	<b>2001</b>
B-1	Lumber River <sup>2</sup>	Scotland	SR 1404	Excellent	Excellent
B-2	Lumber River <sup>2</sup>	Robeson	NC 71	Excellent	Excellent
B-3	Gum Swamp	Robeson	SR 1312	--	Not Impaired
B-4	Lumber River <sup>2</sup>	Robeson	SR 1003	Excellent	Excellent
B-5	Back Swamp	Robeson	SR 1003	--	Not Rated
B-6	Bear Swamp <sup>2</sup>	Robeson	SR 1339	Not Rated	Not Rated
B-7	Lumber River <sup>2</sup>	Robeson	NC 41/72	Excellent	Excellent
B-8	Lumber River <sup>2</sup>	Robeson	NC 72	Good-Fair	Good-Fair
B-9	Lumber River <sup>2</sup>	Robeson	US 74	Good	Excellent
B-10	Porter Swamp <sup>2</sup>	Columbus	SR 1503	Not Rated	Not Rated
B-11	Gapway Swamp <sup>2</sup>	Columbus	SR 1356	Not Rated	Not Rated
<b>Fish Community Monitoring Sites</b>					
<b>Site<sup>1</sup></b>	<b>Waterbody</b>	<b>County</b>	<b>Location</b>	<b>1996</b>	<b>2001</b>
F-1	Back Swamp <sup>2</sup>	Robeson	SR 1003	Not Rated	Not Rated
F-2	Gapway Swamp	Columbus	SR 1356	--	Not Rated
SF-1	Lumber River	Robeson	NC 73	--	Not Rated
SF-2	Lumber River	Robeson	SR 2246	--	Not Rated
SF-3	Lumber River	Robeson	SR 2246	--	Not Rated
SF-4	Lumber River	Robeson	SR 2246	--	Not Rated
<b>Fish Tissue Monitoring Sites</b>					
<b>Site<sup>1</sup></b>	<b>Waterbody</b>	<b>County</b>	<b>Location</b>	<b>1996</b>	<b>2001</b>
T-1	Lumber River	Columbus	US 74	--	--
<b>Ambient Monitoring Sites</b>					
<b>Site<sup>1</sup></b>	<b>Waterbody</b>	<b>County</b>	<b>Location</b>	<b>Station #</b>	<b>Noted Parameters<sup>3</sup></b>
A-1	Lumber River	Scotland	US 401	I2610000	None
A-2	Lumber River	Robeson	NC 71	I2810000	None
A-3	Lumber River	Robeson	SR 1303	I2750000	None
A-4	Lumber River	Robeson	SR 1003	I3050000	None
A-5	Lumber River	Robeson	SR 2121	I4650000	None
A-6	Lumber River	Robeson	US 74	I5690000	None
A-7	Lumber River	Robeson	NC 904	I6410000	None

<sup>1</sup> B = benthic macroinvertebrates; F = fish community; SF = fish community special study site; T = fish tissue; and A = ambient monitoring station.

<sup>2</sup> Historical data available at this site. Refer to Appendix II.

<sup>3</sup> Parameters are noted if in excess of state standards in greater than 10 percent of all samples.

Use support ratings are summarized in Part 2.2 below. Recommendations, current status and future recommendations for waters that were Impaired in 1999 are discussed in Part 2.3 below. Current status and future recommendations for newly Impaired waters are discussed in Part 2.4 below. Supporting waters with noted water quality impacts are discussed in Part 2.5 below. Water quality issues related to the entire subbasin are discussed in Part 2.6. Refer to Appendix III for use support methods and more information on all monitored waters.

## 2.2 Use Support Summary

Use support ratings (page 47) in subbasin 03-07-51 were assigned for aquatic life, fish consumption, recreation and water supply categories. All waters in the subbasin are considered Impaired on an evaluated basis because of a fish consumption advice (page 59). All water supply waters are Supporting on an evaluated basis based on reports from DEH regional water treatment consultants. Refer to Table B-4 for a summary of use support ratings by category for waters in the subbasin.

Table B-4 Summary of Use Support Ratings by Use Support Category in Subbasin 03-07-51

Use Support Rating	Basis	Aquatic Life	Fish Consumption	Recreation	Water Supply
Supporting	Monitored	136.7 mi	0	75.5 mi	0
	All Waters	136.7 mi	0	75.5 mi	83.7 mi
Impaired	Monitored	0	21.5 mi	0	0
	All Waters	0	406.0 mi	0	0
Not Rated	Monitored	45.2 mi	0	0	0
	All Waters		0	0	0
No Data	N/A (No Data)	224.0 mi	0	330.5 mi	0
Total	Monitored	181.9 mi	21.5 mi	75.5 mi	0
	All Waters	406.0 mi	406.0 mi	406.0 mi	83.7 mi
	Percent Monitored	44.8%	5.3%	18.6%	0%

Note: All waters includes monitored, evaluated and waters that were not assessed.

## 2.3 Status and Recommendations of Previously Impaired Waters

There were no Impaired streams identified in the 1999 Lumber River Basinwide Water Quality Plan in this subbasin.

## **2.4 Status and Recommendations for Newly Impaired Waters**

Waters in the following section are identified by assessment unit number (AU#). This number is used to track defined segments in the water quality assessment database and the 303(d) Impaired waters list. The assessment unit number is a subset of the DWQ index number (classification identification number). A letter attached to the end of the AU# indicates that the assessment is smaller than the DWQ index segment. No letter indicates that the assessment unit and the DWQ index segment are the same.

### **2.4.1 Lumber River [AU# 14-(13)e]**

#### *Current Status*

All waters in the subbasin are considered Impaired on an evaluated basis because of fish consumption advice (page 59). However, 21.5 miles of the Lumber River, from below the Fairbluff WWTP at SR 1620/72 in Robeson County to NC 74 in Robeson County, are Impaired on a monitored basis in the fish consumption category. Of the 22 fish samples collected from this section of the Lumber River, 20 samples contained levels that exceeded the state's recommended criterion for methylmercury.

#### *2003 Recommendations*

DWQ will monitor for fish tissue in the Lumber River downstream of Fair Bluff for organics and metals including mercury in 2003. This assessment will be for the purpose of evaluating changes in levels of methylmercury and other contaminants. Refer to page 59 for more information on this issue.

## **2.5 Status and Recommendations for Waters with Noted Impacts**

The surface waters discussed in this section are not Impaired. However, notable water quality problems and concerns have been documented for some waters based on this assessment. Attention and resources should be focused on these waters to prevent additional degradation or facilitate water quality improvement.

Waters in the following section are identified by assessment unit number (AU#). This number is used to track defined segments in the water quality assessment database and the 303(d) Impaired waters list. The assessment unit number is a subset of the DWQ index number (classification identification number). A letter attached to the end of the AU# indicates that the assessment is smaller than the DWQ index segment. No letter indicates that the assessment unit and the DWQ index segment are the same.

### **2.5.1 Lumber River [AU# 14-(13)a]**

#### *Current Status and 2003 Recommendations*

This section of the Lumber River from US Hwy 301 bypass to SR 2289 is currently Supporting based on an Excellent bioclassification at site B-7. The watershed drains the urbanized portions of Lumberton. In this downtown area, the riparian zone, in many places, has been completely removed. In addition, the Lumberton WWTP continues to experience inflow and infiltration

problems after rainfall events. DWQ will continue to work with the facility regarding this issue. Refer to page 73 for a description of urban stream problems and recommendations for reducing impacts and restoring water quality.

Also, during this assessment period a private developer was assessed a civil penalty for land disturbance of filling wetlands and excavation of the floodplain on the Lumber River. DWQ has required the developer to implement a restoration plan as well as retrofit the development to meet state stormwater requirements.

#### Current Water Quality Initiatives

As of December 2002, the NC Division of Parks and Recreation received \$950,000 in grants from the CWMTF to acquire over 3,520 acres for permanent conservation easements along the Lumber River. Lumberton also received \$69,000 in grants from the CWMTF to acquire 24 acres for permanent conservation easements along the Lumber River. In addition, Lumberton received a total of \$1,692,000 in grants from the CWMTF, a \$1,000,000 State Revolving Grant, and a \$1,566,350 State Revolving Loan for wastewater facility upgrades. Also, the towns of Wagram and Pembroke received CWMTF grants for wastewater facility upgrades. See page 152 for project descriptions.

### **2.5.2 Bear Swamp at SR 1339 [AU# 14-9-(1.5)]**

#### Current Status and 2003 Recommendations

Bear Swamp is currently Not Rated. Site B-6 did not meet the necessary criteria to assign bioclassifications (page 57). Most of the Bear Swamp catchment above site B-6 has a heavy agricultural land use (page 76). Trees along the riparian zone have been clear-cut, degrading the habitat (page 62).

#### Current Water Quality Initiatives

Bear Swamp watershed comprises one of 20 watersheds in the Lumber River basin that has been identified by the NC Wetlands Restoration Program (NCWRP) as an area with the greatest need and opportunity for stream and wetland restoration efforts. This watershed will be given higher priority than nontargeted watersheds for the implementation of NCWRP restoration projects. Refer to page 147 in Section C for more information.

### **2.5.3 Long Branch [AU# 14-18-3]**

#### Current Status and 2003 Recommendations

An unnamed tributary of Long Branch was impacted by discharge of animal wastewater from a sprayfield operation. The owner was assessed a civil penalty. DWQ will continue to inspect this operation.

### **2.5.4 Porter Swamp [AU# 14-27]**

#### Current Status and Water Quality Initiatives

Porter Swamp is currently Not Rated. Cape Fear RC&D received a \$20,150 grant from the CWMTF for a no-till drill. See page 152 for project description.

## **2.5.5 Cow Branch, Ivey Branch, Gum Swamp and Mill Branch**

### ***Current Water Quality Initiatives***

Cow Branch, Ivey Branch, Gum Swamp and Mill Branch watersheds comprise four of 20 watersheds in the Lumber River basin that have been identified by the NC Wetlands Restoration Program (NCWRP) as an area with the greatest need and opportunity for stream and wetland restoration efforts. This watershed will be given higher priority than nontargeted watersheds for the implementation of NCWRP restoration projects. Refer to page 147 in Section C for more information.

## **2.6 Additional Water Quality Issues within Subbasin 03-07-51**

This section discusses issues that may threaten water quality in the subbasin that are not specific to particular streams, lakes or reservoirs. The issues discussed may be related to waters near certain land use activities or within proximity to different pollution sources.

### **2.6.1 Water Quality Threats to Streams in Urbanizing Watersheds**

Most of the streams in this subbasin that are not already Impaired from urban stormwater runoff are threatened by development pressure throughout this subbasin. In order to prevent aquatic habitat degradation and impaired biological communities, protection measures must be put in place immediately. Refer to page 73 for a description of urban stream water quality problems and recommendations for reducing impacts to and restoring water quality in these waters.

### **2.6.2 Water Supply Watersheds (Back Swamp, Lumber River, Bear Swamp, Jacks Branch)**

A total of 83.7 total stream miles (20.6 percent) in this subbasin are classified as water supply watersheds (WS-IV and WS-V). The water supply classifications on the Lumber River are also designated as HWQ. See page 36 for more information regarding surface water classifications. Local governments having jurisdiction within the water supply watersheds are encouraged to implement a more protective local water supply watershed ordinance than the state's minimal requirements. For example, a more protective land use ordinance could require a wider natural, undisturbed riparian buffer. Local governments are also encouraged to retain these water supply classifications. This will continue further protection for the water supply watersheds. See page 39 for more information regarding this issue.

### **2.6.3 Timber Harvesting (Lumber River Mainstem)**

Clear-cutting was observed in areas near the banks of the Lumber River. These activities were most commonly observed during drought conditions. During harvesting activities, the implementation of Forestry Best Management Practices (BMPs) and meeting compliance standards outlined in the Forest Practices Guidelines is encouraged by the Divisions of Forest Resources and Water Quality to avoid stormwater runoff to the adjacent streams and rivers (see page 33 for more information).





## Section B - Chapter 3

### Lumber River Subbasin 03-07-52

#### Raft Swamp

### 3.1 Subbasin Overview

#### ***Subbasin 03-07-52 at a Glance***

##### **Land and Water Area**

Total area:	171 mi <sup>2</sup>
Land area:	170 mi <sup>2</sup>
Water area:	1 mi <sup>2</sup>

##### **Population Statistics**

2000 Est. Pop.: 18,848 people

##### **Land Cover (percent)**

Forest/Wetland:	49
Surface Water:	<1
Urban:	1
Agriculture:	1

##### **Counties**

Hoke and Robeson

##### **Municipalities**

Lumberton, Raeford, Red Springs  
and Rennert

This subbasin is within Hoke and Robeson counties. The riparian zones along Raft Swamp and many of the major tributaries contain wetlands. The upland sections of the catchments are in heavy agricultural land use.

Little Raft Swamp drains out of the heaviest populated municipality, Red Springs (population: 3,493). There are three NPDES wastewater discharge permits in this subbasin with a total permitted flow of 3.5 MGD (Figure B-3). The largest is Red Springs WWTP discharging 2.5 MGD. Refer to Appendix I for identification and more information on NPDES permit holders. Hoke County will be required to develop a stormwater program under Phase II (page 69). Hoke County's estimated population change is 24,245 for the 2000-2020 year projection, see Table A-5 in Section A for more details. There are also seven registered swine animal operations in this subbasin.

There were three benthic macroinvertebrate community sites sampled in 2001 as part of basinwide monitoring. All three sites were Not Rated, as biocriteria were being developed (page 57) to assess swamp streams. One of the

benthic sites was a special study investigation. Data were collected from two ambient monitoring stations as well. See Figure B-3 and Table B-5 for more information on location and summaries for these data sites. Refer to the 2002 *Lumber River Basinwide Assessment Report* at <http://www.esb.enr.state.nc.us/bar.html> and Section A, Chapter 3 for more information on monitoring.

Use support ratings are summarized in Part 3.2 below. Recommendations, current status and future recommendations for waters that were Impaired in 1999 and newly Impaired waters are discussed in Part 3.3 below. Supporting waters with noted water quality impacts are discussed in Part 3.4 below. Water quality issues related to the entire subbasin are discussed in Part 3.5. Refer to Appendix III for use support methods and more information on all monitored waters.

Figure B-3 Lumber River Subbasin 03-07-52

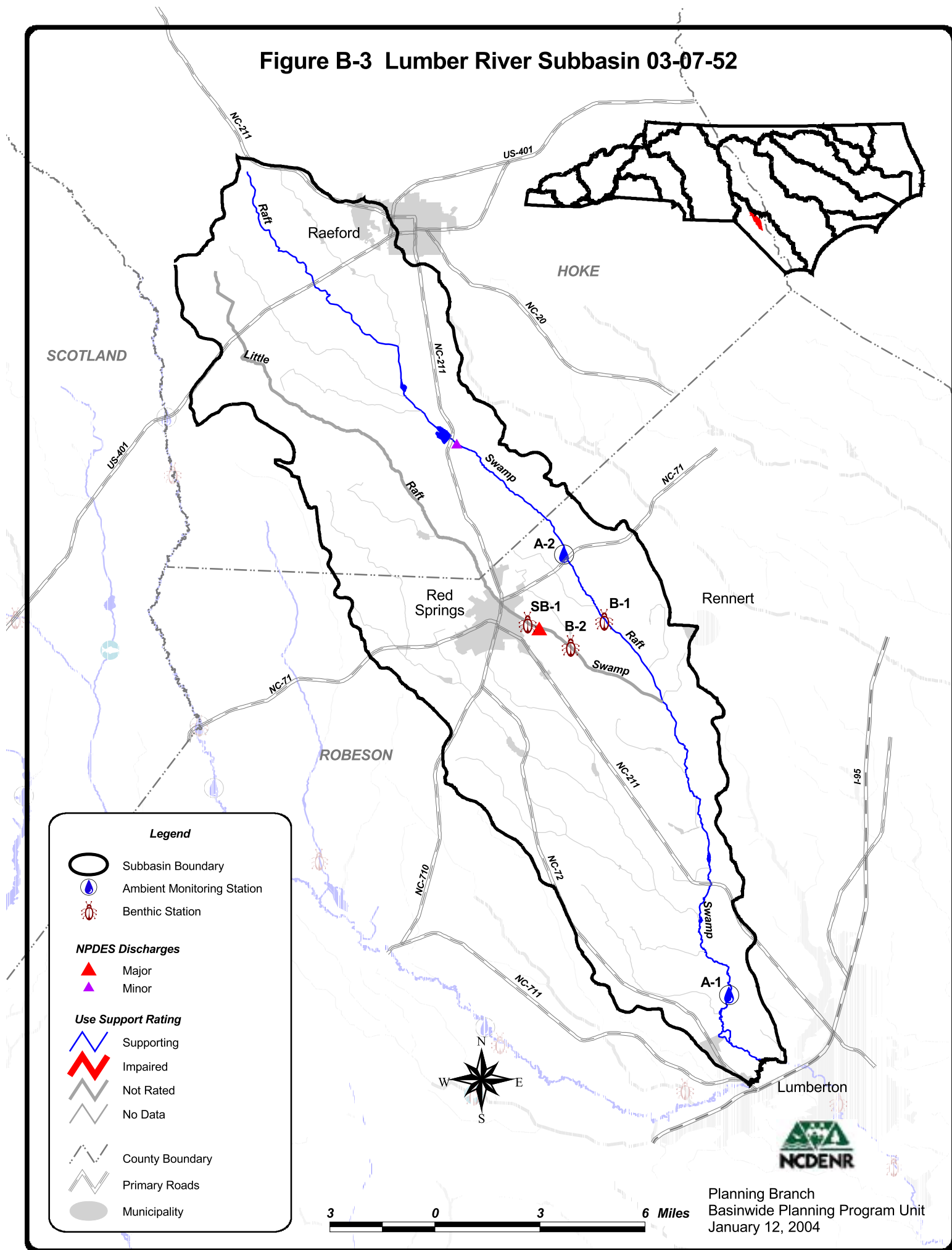


Table B-5 DWQ Monitoring Locations, Bioclassifications and Notable Chemical Parameters (1996-2001) for Subbasin 03-07-52

<b>Benthic Macroinvertebrate Community Monitoring Sites</b>					
<b>Site<sup>1</sup></b>	<b>Waterbody</b>	<b>County</b>	<b>Location</b>	<b>1996</b>	<b>2001</b>
B-1	Raft Swamp	Robeson	SR 1505	--	Not Rated
B-2	Little Raft Swamp	Robeson	SR 1505	--	Not Rated
SB-1	Little Raft Swamp	Robeson	SR 1776	--	Not Rated
<b>Ambient Monitoring Sites</b>					
<b>Site<sup>1</sup></b>	<b>Waterbody</b>	<b>County</b>	<b>Location</b>	<b>Station #</b>	<b>Noted Parameters<sup>2</sup></b>
A-1	Raft Swamp	Robeson	SR 1527	I3690000	None
A-2	Raft Swamp	Robeson	NC 71	I3730000	None

<sup>1</sup> B = benthic macroinvertebrates; SB = benthic macroinvertebrates special study site; and A = ambient monitoring station.

<sup>2</sup> Parameters are noted if in excess of state standards in greater than 10 percent of all samples.

### 3.2 Use Support Summary

Use support ratings (page 47) in subbasin 03-07-52 were assigned for aquatic life, recreation, fish consumption and water supply categories. All waters in the subbasin are considered Impaired on an evaluated basis because of a fish consumption advice (page 59). All water supply waters are Supporting on an evaluated basis based on reports from DEH regional water treatment consultants. Refer to Table B-6 for a summary of use support ratings by category for waters in the subbasin.

Table B-6 Summary of Use Support Ratings by Use Support Category in Subbasin 03-07-52

<b>Use Support Rating</b>	<b>Basis</b>	<b>Aquatic Life</b>	<b>Recreation</b>	<b>Fish Consumption</b>	<b>Water Supply</b>
Supporting	Monitored	37.0 mi	37.0 mi	0	0
	All Waters	37.0 mi	37.0 mi	0	39.4 mi
Impaired	Monitored	0	0	0	0
	All Waters	0	0	142.3 mi	0
Not Rated	Monitored	19.9 mi	0	0	0
No Data	N/A	85.4 mi	105.3 mi	0	0
Total	Monitored	56.9 mi	37.0 mi	0	0
	All Waters	142.3 mi	142.3 mi	142.3 mi	39.4 mi
	Percent Monitored	40.0%	26%	0%	0%

Note: All waters include monitored, evaluated and waters that were not assessed.

### **3.3 Status and Recommendations of Previously and Newly Impaired Waters**

There were no Impaired streams identified in the 1999 Lumber River Basinwide Plan in this subbasin. All waters in the subbasin are considered Impaired on an evaluated basis because of a fish consumption advice (page 59). There are no other newly Impaired waters in subbasin 03-07-52. Refer to Part 3.4 below for information on waters with noted water quality impacts.

### **3.4 Status and Recommendations for Waters with Noted Impacts**

The surface waters discussed in this section are not Impaired. However, notable water quality problems and concerns have been documented for some waters based on this assessment. Attention and resources should be focused on these waters to prevent additional degradation or facilitate water quality improvement.

Waters in the following section are identified by assessment unit number (AU#). This number is used to track defined segments in the water quality assessment database and the 303(d) Impaired waters list. The assessment unit number is a subset of the DWQ index number (classification identification number). A letter attached to the end of the AU# indicates that the assessment is smaller than the DWQ index segment. No letter indicates that the assessment unit and the DWQ index segment are the same.

#### **3.4.1 Little Raft Swamp [AU# 14-10-5]**

##### *Current Status and 2003 Recommendations*

Little Raft Swamp is currently Not Rated. The Red Springs WWTP has experienced past noncompliance problems with fecal coliform bacteria and ammonia levels as well as toxicity test failures. The facility is under a Special Order of Consent and is required to address these issues as well as investigate other alternatives for discharge relocation. In February 2001, DWQ conducted a benthic macroinvertebrate special study investigation on Little Raft Swamp to determine if there were impacts from the WWTP. While the conductivity was much lower at the upstream site than at the downstream site, there was no clear shift in the benthic community. Refer to the 2002 *Lumber River Basinwide Assessment Report* at <http://www.esb.enr.state.nc.us/bar.html> and Section A, Chapter 3 for more information on monitoring.

##### *Current Water Quality Initiatives*

As of December 2002, the Town of Red Springs received a \$351,000 grant from the Clean Water Management Trust Fund for sewer rehabilitation. See page 152 for project description.

#### **3.4.2 Lower Raft Swamp**

##### *Current Water Quality Initiatives*

Lower Raft Swamp watershed comprises one of 20 watersheds in the Lumber River basin that has been identified by the NC Wetlands Restoration Program (NCWRP) as an area with the greatest need and opportunity for stream and wetland restoration efforts. This watershed will be

given higher priority than nontargeted watersheds for the implementation of NCWRP restoration projects. Refer to page 147 in Section C for more information.

### **3.5 Additional Water Quality Issues within Subbasin 03-07-52**

This section discusses issues that may threaten water quality in the subbasin that are not specific to particular streams. The issues discussed may be related to waters near certain land use activities or within proximity to different pollution sources.

#### **3.5.1 Water Supply Watersheds**

**(Raft Swamp, Richland Swamp, Burnt Swamp, White Oak Branch, Holy Swamp)**

A total of 39.4 total stream miles (27.7 percent) in this subbasin are classified as water supply watersheds (WS-IV). See page 36 for more information regarding surface water classifications. Local governments having jurisdiction within the water supply watersheds are encouraged to implement a more protective local water supply watershed ordinance than the state's minimal requirements. For example, a more protective land use ordinance could require a wider natural, undisturbed riparian buffer. Local governments are also encouraged to retain these water supply classifications. This will continue further protection for the water supply watersheds. See page 39 for more information regarding this issue.



## Section B - Chapter 4

### Lumber River Subbasin 03-07-53

#### Big Swamp

#### 4.1 Subbasin Overview

##### ***Subbasin 03-07-53 at a Glance***

###### **Land and Water Area**

Total area:	454 mi <sup>2</sup>
Land area:	445 mi <sup>2</sup>
Water area:	9 mi <sup>2</sup>

###### **Population Statistics**

2000 Est. Pop.: 47,513 people

###### **Land Cover (percent)**

Forest/Wetland:	46
Surface Water:	<1
Urban:	<1
Agriculture:	37

###### **Counties**

Bladen, Columbus, Hoke and Robeson

###### **Municipalities**

Bladenboro, Boardman, Dublin, Lumber Bridge, Parkton, Rennert, Saint Pauls and Tar Heel

Big Swamp is the main tributary in this subbasin. Many of the riparian zones contain undeveloped, forested pocosin wetlands. Big Swamp and its tributaries are typical swamp streams with tannin-colored water and very low summer flows. This subbasin is rural and is heavily farmed, primarily in row crops. Larger municipalities include the towns of Bladenboro, Saint Pauls and Parkton.

There are five NPDES wastewater discharge permits in this subbasin with a total permitted flow of 1.2 MGD. Refer to Appendix I for identification and more information on NPDES permit holders. Hoke County will be required to develop a stormwater program under Phase II (page 69). Hoke County's estimated population change is 24,245 for the 2000-2020 year projection (see Table A-5 in Section A for more details). The largest number of registered swine animal operations in the entire Lumber River basin is located in this subbasin at 37 facilities.

Two benthic macroinvertebrate community sites were sampled in 2001 as part of basinwide monitoring. Both sites were Not Rated, as biocriteria were being developed (page 57) to assess swamp streams. One fish community

site was sampled as part of a special study investigation for developing criteria to assess nonwadeable coastal streams (page 57). Data were collected from one ambient monitoring station as well. See Figure B-4 and Table B-7 for locations and summaries of these monitoring sites. Refer to the *2002 Lumber River Basinwide Assessment Report* at <http://www.esb.enr.state.nc.us/bar.html> and Section A, Chapter 3 for more information on monitoring.

Use support ratings are summarized in Part 4.2 below. Recommendations, current status and future recommendations for waters that were Impaired in 1999 and newly Impaired waters are discussed in Part 4.3 below. Supporting waters with noted water quality impacts are discussed in Part 4.4 below. Water quality issues related to the entire subbasin are discussed in Part 4.5. Refer to Appendix III for use support methods and more information on all monitored waters.

Figure B-4 Lumber River Subbasin 03-07-53

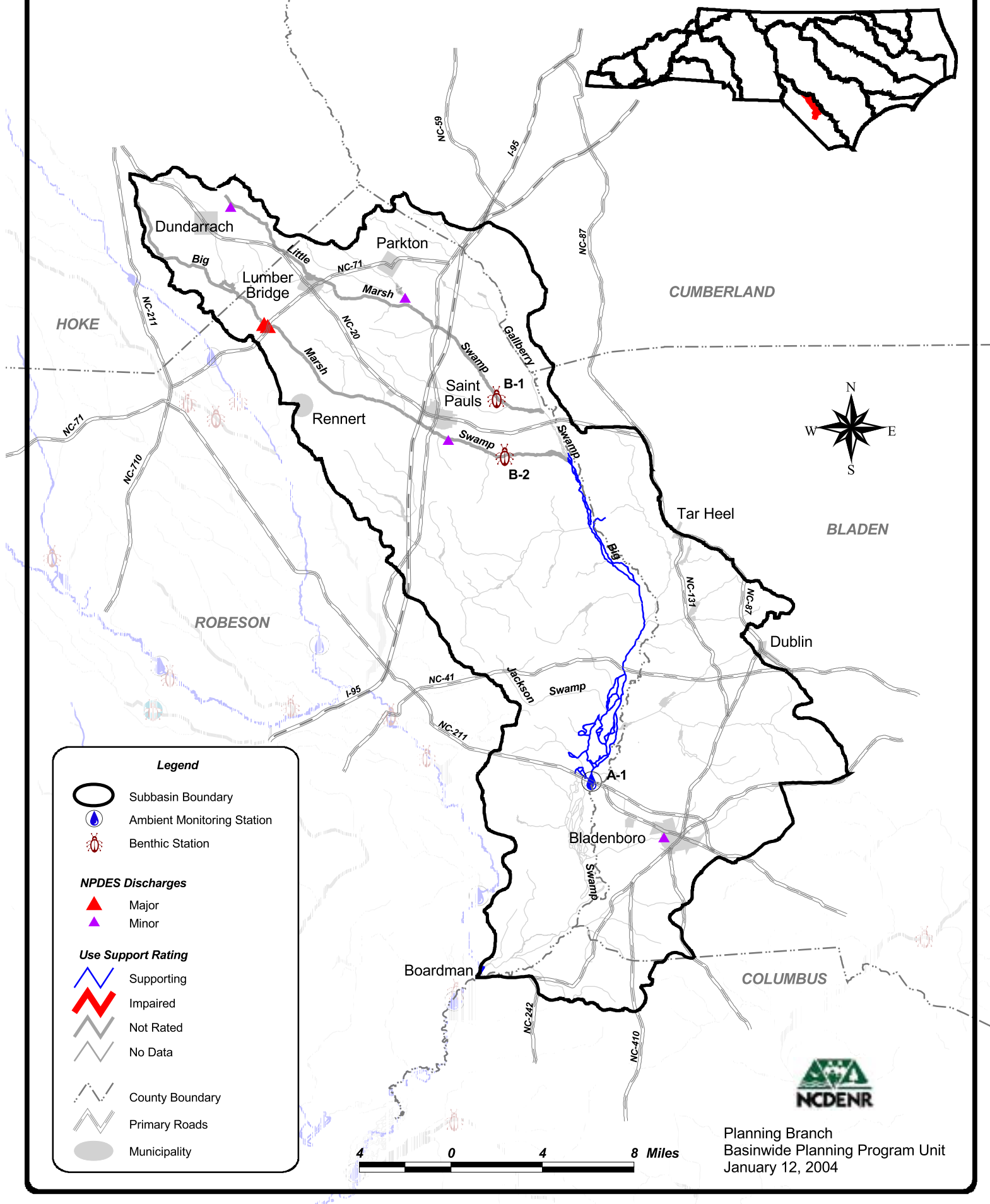




Table B-7 DWQ Monitoring Locations, Bioclassifications and Notable Chemical Parameters (1996-2001) for Subbasin 03-07-53

<b>Benthic Macroinvertebrate Community Monitoring Sites</b>					
<b>Site<sup>1</sup></b>	<b>Waterbody</b>	<b>County</b>	<b>Location</b>	<b>1996</b>	<b>2001</b>
B-1	Little Marsh Swamp	Robeson	SR 1907	--	Not Rated
B-2	Big Marsh Swamp <sup>2</sup>	Robeson	SR 1924	--	Not Rated
<b>Fish Community Monitoring Sites</b>					
<b>Site<sup>1</sup></b>	<b>Waterbody</b>	<b>County</b>	<b>Location</b>	<b>1996</b>	<b>2001</b>
SF-1	Big Swamp	Robeson	SR 1002	--	Not Rated
<b>Ambient Monitoring Sites</b>					
<b>Site<sup>1</sup></b>	<b>Waterbody</b>	<b>County</b>	<b>Location</b>	<b>Station #</b>	<b>Noted Parameters<sup>3</sup></b>
A-1	Big Swamp	Robeson	NC 211	I5370000	None

<sup>1</sup> B = benthic macroinvertebrates; SF = fish community special study site; and A = ambient monitoring station.

<sup>2</sup> Historical data available at this site. Refer to Appendix II.

<sup>3</sup> Parameters are noted if in excess of state standards in greater than 10 percent of all samples.

## 4.2 Use Support Summary

Use support ratings (page 47) in subbasin 03-07-53 were assigned for aquatic life, recreation and fish consumption categories. All waters in the subbasin are considered Impaired on an evaluated basis because of a fish consumption advice (page 59). Refer to Table B-8 for a summary of use support ratings by category for waters in the subbasin.

Table B-8 Summary of Use Support Ratings by Use Support Category in Subbasin 03-07-53

<b>Use Support Rating</b>	<b>Basis</b>	<b>Aquatic Life</b>	<b>Recreation</b>	<b>Fish Consumption</b>
Supporting	Monitored	15.4 mi	15.4 mi	0
	All Waters	15.4 mi	15.4 mi	0
Impaired	Monitored	0	0	0
	All Waters	0	0	329.1 mi
Not Rated	Monitored	48.0 mi	0	0
No Data	N/A	265.8 mi	313.7 mi	0
Total	Monitored	63.4 mi	15.4 mi	0
	All Waters	329.1 mi	329.1 mi	329.1 mi
	Percent Monitored	19.3%	4.7%	0%

Note: All waters include monitored, evaluated and waters that were not assessed.

### **4.3 Status and Recommendations of Previously and Newly Impaired Waters**

There were no Impaired streams identified in the 1999 Lumber River Basinwide Plan in this subbasin. All waters in the subbasin are considered Impaired on an evaluated basis because of a fish consumption advice (page 59). There are no other newly Impaired waters in subbasin 03-07-53. Refer to Part 4.4 below for information on waters with noted water quality impacts.

### **4.4 Status and Recommendations for Waters with Noted Impacts**

The surface waters discussed in this section are not Impaired. However, notable water quality problems and concerns have been documented for some waters based on this assessment. Attention and resources should be focused on these waters to prevent additional degradation or facilitate water quality improvement.

Waters in the following section are identified by assessment unit number (AU#). This number is used to track defined segments in the water quality assessment database and the 303(d) Impaired waters list. The assessment unit number is a subset of the DWQ index number (classification identification number). A letter attached to the end of the AU# indicates that the assessment is smaller than the DWQ index segment. No letter indicates that the assessment unit and the DWQ index segment are the same.

#### **4.4.1 Dunns Marsh [AU# 14-22-1-3-2]**

##### *Current Status and 2003 Recommendations*

The Parkton WWTP has experienced significant noncompliance issues with fecal coliform bacteria levels and failing toxicity tests. The plant has improved and continues to improve regarding their fecal coliform levels. As of December 2002, the facility continued to experience toxicity problems associated with chlorine and has made modifications to address this issue. DWQ will continue to work with the plant regarding failing toxicity tests.

##### *Current Water Quality Initiatives*

As of December 2002, the facility received a \$670,000 grant from the CWMTF for sewer rehabilitation. See page 152 for project description.

#### **4.4.2 Mill Swamp [AU# 14-22-9]**

##### *Current Status and 2003 Recommendations*

Mill Swamp, a tributary of Big Swamp, was impacted by discharge of animal wastewater from a sprayfield operation. The owner was assessed a civil penalty. DWQ will continue to inspect this operation.

#### **4.4.3 Cold Camp Creek**

##### *Current Water Quality Initiatives*

The Cold Camp Creek watershed comprises one of 20 watersheds in the Lumber River basin that has been identified by the NC Wetlands Restoration Program (NCWRP) as an area with the greatest need and opportunity for stream and wetland restoration efforts. This watershed will be given higher priority than nontargeted watersheds for the implementation of NCWRP restoration projects. Refer to page 147 in Section C for more information.

#### **4.4.4 Big Marsh Swamp [AU# 14-22-2]**

##### *Current Water Quality Initiatives*

The Town of St. Pauls received a total of \$391,000 in grants from the CWMTF and a \$1,186,000 State Revolving Grant for wastewater facility upgrades. See page 152 for project descriptions.

#### **4.4.5 Bryant Swamp [AU# 14-22-15]**

##### *Current Water Quality Initiatives*

The Town of Bladenboro received a \$1,863,000 grant from the CWMTF for a wastewater land application system. See page 152 for project description.

### **4.5 Additional Water Quality Issues within Subbasin 03-07-53**

This section discusses issues that may threaten water quality in the subbasin that are not specific to particular streams. The issues discussed may be related to waters near certain land use activities or within proximity to different pollution sources.

A large majority of the land use in this subbasin is agriculture. Most of these streams are threatened by excessive loading of nutrients, contaminants and sedimentation. In order to prevent aquatic habitat degradation and impaired biological communities, protection measures must be put in place immediately. Refer to page 76 for a description of water quality problems and recommendations for reducing impacts to and restoring water quality in these waters.



## Section B - Chapter 5

### Lumber River Subbasin 03-07-54

Ashpole Swamp

#### 5.1 Subbasin Overview

##### ***Subbasin 03-07-54 at a Glance***

###### **Land and Water Area**

Total area:	226 mi <sup>2</sup>
Land area:	220 mi <sup>2</sup>
Water area:	6 mi <sup>2</sup>

###### **Population Statistics**

2000 Est. Pop.: 28,523 people

###### **Land Cover (percent)**

Forest/Wetland:	46
Surface Water:	1
Urban:	<1
Agriculture:	52

###### **Counties**

Robeson

###### **Municipalities**

Fairmont, Marietta, McDonald, Proctorville and Raynham

Streams in this subbasin are very wide, with tannin-colored water and little visible current under summer low flow conditions, typical of coastal plain streams.

Land use is a mixture of agriculture and forest, with small amounts of urban development near Fairmont.

A total of 15 registered swine operations are located in this subbasin. There used to be only one NPDES wastewater discharge permit, Fairmont WWTP, in the subbasin. However, this WWTP has since constructed a new regional plant and is now discharging into the Lumber River, subbasin 03-07-51.

Two benthic macroinvertebrate community sites were sampled in 2001 as part of basinwide monitoring. Both sites were Not Rated, as biocriteria were being developed (page 57) to assess these swampy streams. Data were also collected from one ambient station. See Figure B-5 and Table B-9 for locations and summaries of these monitoring sites. Refer to the *2002 Lumber River Basinwide Assessment Report* at

<http://www.esb.enr.state.nc.us/bar.html> and Section A, Chapter 3 for more information on monitoring.

Use support ratings are summarized in Part 5.2 below. Recommendations, current status and future recommendations for waters that were Impaired in 1999 and newly Impaired waters are discussed in Part 5.3 below. Supporting waters with noted water quality impacts are discussed in Part 5.4 below. Refer to Appendix III for use support methods and more information on all monitored waters.

Figure B-5 Lumber River Subbasin 03-07-54

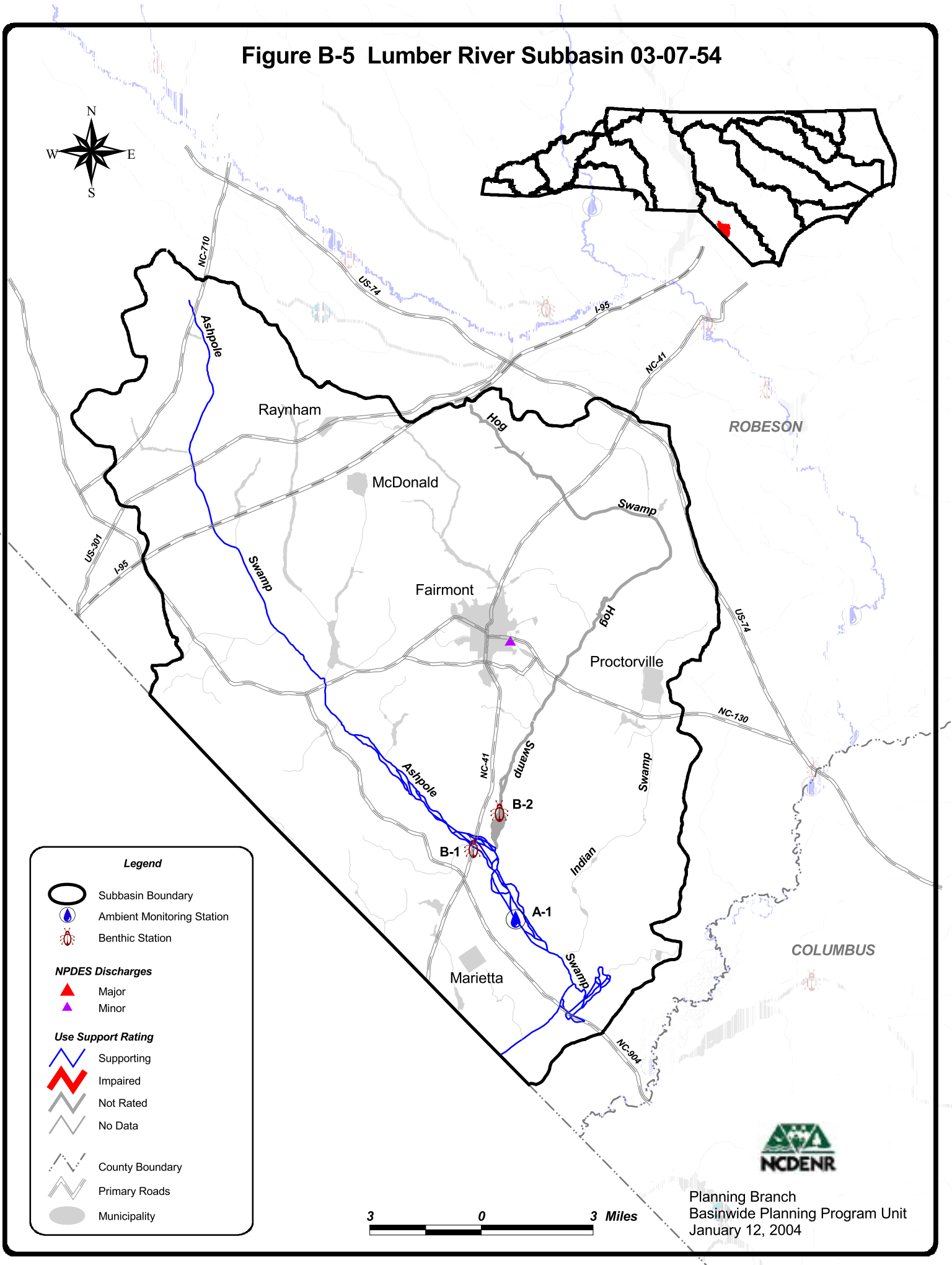


Table B-9 DWQ Monitoring Locations, Bioclassifications and Notable Chemical Parameters (1996-2001) for Subbasin 03-07-54

Benthic Macroinvertebrate Community Monitoring Sites					
Site <sup>1</sup>	Waterbody	County	Location	1996	2001
B-1	Ashpole Swamp <sup>2</sup>	Robeson	NC 41	Not Rated	Not Rated
B-2	Hog Swamp <sup>2</sup>	Robeson	SR 2262	Not Rated	Not Rated
Ambient Monitoring Sites					
Site <sup>1</sup>	Waterbody	County	Location	Station #	Noted Parameters <sup>3</sup>
A-1	Ashpole Swamp	Robeson	SR 2258	I6290000	None

<sup>1</sup> B = benthic macroinvertebrates; A = ambient monitoring station

<sup>2</sup> Historical data available at this site. Refer to Appendix II.

<sup>3</sup> Parameters are noted if in excess of state standards in greater than 10 percent of all samples.

## 5.2 Use Support Summary

Use support ratings (page 47) in subbasin 03-07-54 were assigned for aquatic life, recreation and fish consumption categories. All waters in the subbasin are considered Impaired on an evaluated basis because of a fish consumption advice (page 59). Refer to Table B-10 for a summary of use support ratings by use support category for waters in the subbasin.

Table B-10 Summary of Use Support Ratings by Use Support Category in Subbasin 03-07-54

Use Support Rating	Basis	Aquatic Life	Recreation	Fish Consumption
Supporting	Monitored	25.7 mi	6.9 mi	0
	All Waters	25.7 mi	6.9 mi	0
Impaired	Monitored	0	0	0
	All Waters	0	0	91.1 mi 11.8 ac
Not Rated	Monitored	4.9 mi	0	0
No Data	N/A	60.9 mi 11.8 ac	84.2 mi 11.8 ac	0
Total	Monitored	30.6 mi	6.9 mi	0
	All Waters	91.1 mi 11.8 ac	91.1 mi 11.8 ac	329.1 mi 11.8 ac
	Percent Monitored	33.6% mi	7.6% mi	0%

Note: All waters include monitored, evaluated and waters that were not assessed.

### **5.3 Status and Recommendations of Previously and Newly Impaired Waters**

There were no Impaired streams identified in the 1999 Lumber River Basinwide Plan in this subbasin. All waters in the subbasin are considered Impaired on an evaluated basis because of a fish consumption advice (page 59). There are no other newly Impaired waters in subbasin 03-07-54. Refer to Part 5.4 below for information on waters with noted water quality impacts.

### **5.4 Status and Recommendations for Waters with Noted Impacts**

The surface waters discussed in this section are not Impaired. However, notable water quality problems and concerns have been documented for some waters based on this assessment. Attention and resources should be focused on these waters to prevent additional degradation or facilitate water quality improvement.

Waters in the following section are identified by assessment unit number (AU#). This number is used to track defined segments in the water quality assessment database and the 303(d) Impaired waters list. The assessment unit number is a subset of the DWQ index number (classification identification number). A letter attached to the end of the AU# indicates that the assessment is smaller than the DWQ index segment. No letter indicates that the assessment unit and the DWQ index segment are the same.

#### **5.4.1 Pittman Mill Branch [AU# 14-30-7-4-3]**

##### *Current Status and 2003 Recommendations*

The former Fairmont WWTP, which currently does not discharge, did experience noncompliance issues with total suspended solids and biochemical oxygen demand in this assessment period. The town received \$1,000,000 from the Clean Water Management Trust Fund to construct a new Fairmont Regional WWTP. This new regional plant which now discharges to the Lumber River is functioning and in compliance.

#### **5.4.2 Ashpole Swamp [AU# 14-30a&b]**

##### *Current Status and 2003 Recommendations*

Ashpole Swamp is currently Not Impaired in North Carolina. However, it is Impaired in South Carolina for dissolved oxygen. Consequently, in the future, North Carolina would be subject to an interstate TMDL. DWQ will work cooperatively with South Carolina as they develop a TMDL for Ashpole Swamp.



## Section B - Chapter 6

### Lumber River Subbasin 03-07-55

#### Gum Swamp, Leith Creek and Shoe Heel Creek

## 6.1 Subbasin Overview

### ***Subbasin 03-07-55 at a Glance***

#### **Land and Water Area**

Total area:	391 mi <sup>2</sup>
Land area:	387 mi <sup>2</sup>
Water area:	4 mi <sup>2</sup>

#### **Population Statistics**

2000 Est. Pop.: 44,626 people

#### **Land Cover (percent)**

Forest/Wetland:	61
Surface Water:	1
Urban:	1
Agriculture:	37

#### **Counties**

Gibson, Laurinburg, Maxton,  
Rowland and Wagram

#### **Municipalities**

Richmond, Robeson and Scotland

Most of this subbasin lies within the Sandhills ecoregion, characterized by sandy streams with year-round flow. The headwaters of Gum Swamp and Shoe Heel Creek are located in the Sandhills Game Land Area. Land use is a mixture of agriculture and forest, with some urban areas near Laurinburg and Maxton. Portions of Richmond, Scotland and Robeson counties are located in this subbasin.

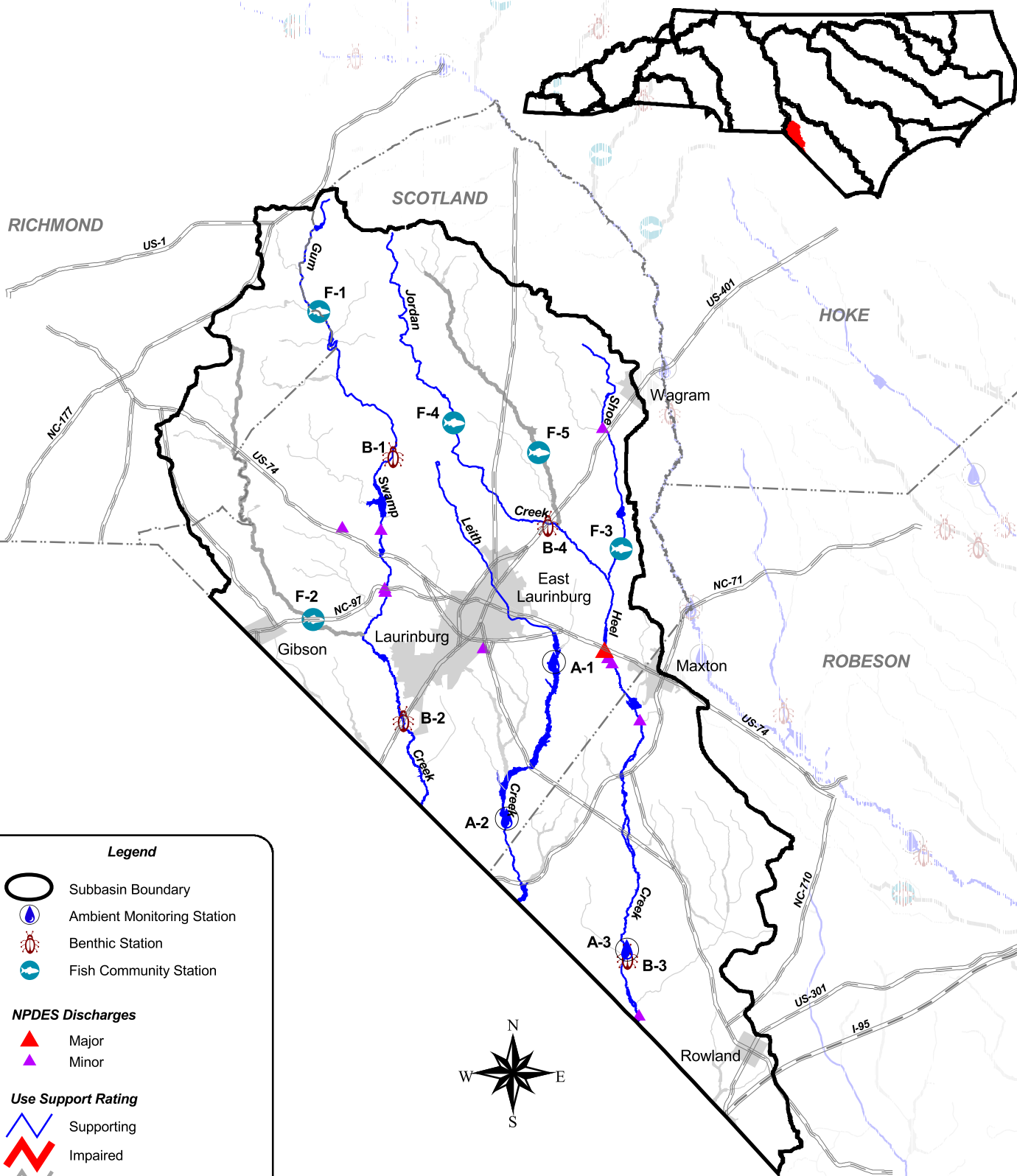
There are 11 NPDES wastewater discharge permits in this subbasin with a total permitted flow of 5.4 MGD. There is one individual NPDES stormwater permit in the subbasin, and there are also 30 registered swine operations in this subbasin.

There were four benthic macroinvertebrate community sites sampled in 2001 as part of basinwide monitoring. Two of the sites remained at the same bioclassification. One site received a higher bioclassification since the 1996 sampling and the other site received a lower bioclassification. Five fish community sites were sampled for the first time in this subbasin. All of the fish

community sites were Not Rated, as biocriteria are being developed (page 57). See Figure B-6 and Table B-11 for locations and summaries of these monitoring sites. Refer to the *2002 Lumber River Basinwide Assessment Report* at <http://www.esb.enr.state.nc.us/bar.html> and Section A, Chapter 3 for more information on monitoring.

Use support ratings are summarized in Part 6.2 below. Recommendations, current status and future recommendations for waters that were Impaired in 1999 and newly Impaired waters are discussed in Part 6.3 below. Supporting waters with noted water quality impacts are discussed in Part 6.4 below. Water quality issues related to the entire subbasin are discussed in Part 6.5. Refer to Appendix III for use support methods and more information on all monitored waters.

Figure B-6 Lumber River Subbasin 03-07-55



**Legend**

- Subbasin Boundary
- Ambient Monitoring Station
- Benthic Station
- Fish Community Station

**NPDES Discharges**

- Major
- Minor

**Use Support Rating**

- Supporting
- Impaired
- Not Rated
- No Data

- County Boundary
- Primary Roads
- Municipality



Planning Branch  
Basinwide Planning Program Unit  
January 12, 2004

Table B-11 DWQ Monitoring Locations, Bioclassifications and Notable Chemical Parameters (1996-2001) for Subbasin 03-07-55

<b>Benthic Macroinvertebrate Community Monitoring Sites</b>					
<b>Site<sup>1</sup></b>	<b>Waterbody</b>	<b>County</b>	<b>Location</b>	<b>1996</b>	<b>2001</b>
B-1	Gum Swamp <sup>2</sup>	Scotland	SR 1323	Good-Fair	Good
B-2	Gum Swamp <sup>2</sup>	Scotland	US 15/401	Good	Good
B-3	Shoe Heel Creek <sup>2</sup>	Robeson	SR 1101	Excellent	Good
B-4	Jordan Creek	Scotland	US 401	Good-Fair	Good-Fair
<b>Fish Community Monitoring Sites</b>					
<b>Site<sup>1</sup></b>	<b>Waterbody</b>	<b>County</b>	<b>Location</b>	<b>1996</b>	<b>2001</b>
F-1	Gum Swamp	Scotland	SR 1344	--	Not Rated
F-2	Joes Creek	Scotland	NC 79	--	Not Rated
F-3	Shoe Heel Creek	Scotland	SR 1433	--	Not Rated
F-4	Jordan Creek	Scotland	SR 1324	--	Not Rated
F-5	Juniper Creek	Scotland	SR 1405	--	Not Rated
<b>Ambient Monitoring Sites</b>					
<b>Site<sup>1</sup></b>	<b>Waterbody</b>	<b>County</b>	<b>Location</b>	<b>Station #</b>	<b>Noted Parameters<sup>3</sup></b>
A-1	Leith Creek	Scotland	SR 1609	I0490000	None
A-2	Leith Creek	Scotland	SR 1615	I0510000	Fecal coliform bacteria
A-3	Shoe Heel Creek	Robeson	SR 1101	I1530000	None

<sup>1</sup> B = benthic macroinvertebrates; F = fish community; A = ambient monitoring station.

<sup>2</sup> Historical data available at this site. Refer to Appendix II.

<sup>3</sup> Parameters are noted if in excess of state standards in greater than 10 percent of all samples.

## 6.2 Use Support Summary

Use support ratings (page 47) in subbasin 03-07-55 were assigned for aquatic life, recreation and fish consumption category. All waters in the subbasin are considered Impaired on an evaluated basis because of a fish consumption advice (page 59). Refer to Table B-12 for a summary of use support ratings by category for waters in the subbasin.

Table B-12 Summary of Use Support Ratings by Use Support Category in Subbasin 03-07-55

Use Support Rating	Basis	Aquatic Life	Fish Consumption	Recreation
Supporting	Monitored	106.4 mi	0	52.1 mi
	All Waters	106.4 mi	0	52.1 mi
Impaired	Monitored	0	0	0
	All Waters	0	254.1 mi	0
Not Rated	Monitored	28.5 mi	0	5.0 mi
No Data	N/A	125.2	0	203.1 mi
Total	Monitored	134.9 mi	0	57.2 mi
	All Waters	260.2 mi	260.2 mi	260.2 mi
	Percent Monitored	51.8%	0%	22.5%

Note: All waters include monitored, evaluated and waters that were not assessed.

### 6.3 Status and Recommendations of Previously and Newly Impaired Waters

There were no Impaired streams identified in the 1999 Lumber River Basinwide Plan in this subbasin. All waters in the subbasin are considered Impaired on an evaluated basis because of a fish consumption advice (page 59). There are no other newly Impaired waters in subbasin 03-07-55. Refer to Part 6.4 below for information on waters with noted water quality impacts.

### 6.4 Status and Recommendations for Waters with Noted Impacts

The surface waters discussed in this section are not Impaired. However, notable water quality problems and concerns have been documented for some waters based on this assessment. Attention and resources should be focused on these waters to prevent additional degradation or facilitate water quality improvement.

Waters in the following section are identified by assessment unit number (AU#). This number is used to track defined segments in the water quality assessment database and the 303(d) Impaired waters list. The assessment unit number is a subset of the DWQ index number (classification identification number). A letter attached to the end of the AU# indicates that the assessment is smaller than the DWQ index segment. No letter indicates that the assessment unit and the DWQ index segment are the same.

#### **6.4.1 Leith Creek [AU# 14-33b]**

##### *Current Status and 2003 Recommendations*

Leith Creek is currently Supporting for the aquatic life category. It is concurrently Not Rated for the recreation category. Data from the ambient monitoring station I0510000, located at SR 1615 near Smyrna Church in Scotland County, show an elevated fecal coliform bacteria level. Specifically, these data show more than 20 percent of the samples were greater than 400 colonies per 100 ml. Typically, these data are identified for potential follow-up monitoring conducted five times within 30 days as specified by the state fecal coliform bacteria standard. Due to limited resources and the higher risk to human health, primary recreation waters (Class B, SB and SA) will be given monitoring priority for additional five times within 30 days sampling. However, this stream segment is classified C, Sw and follow-up water quality sampling for Class C waters will be performed as resources permit. See page 66 for more information on fecal coliform bacteria. For more detailed information regarding use support methodology, refer to Appendix III.

##### *Current Water Quality Initiative*

The Town of Gibson received a \$286,500 grant from the CWMTF to rehabilitate the wastewater collection system. See page 152 for project description.

#### **6.4.2 Shoe Heel Creek [AU# 14-34]**

##### *Current Status and 2003 Recommendations*

Shoe Heel Creek at SR 1101 in Robeson County is currently Supporting based on a Good bioclassification at site B-3. However, the bioclassification has lowered from the 1996 sample. DWQ will continue to monitor this site to determine if there are any long-term changes in water quality. Rowland WWTP has been noncompliant with inflow and infiltration limits. The facility is currently on a Special Order of Consent. DWQ will continue to work with the facility to rectify their issue.

##### *Current Water Quality Initiative*

During this assessment period (1996-2001), the Town of Wagram tied into Laurinburg-Maxton Airport WWTP which eliminated the town's septic system.

#### **6.4.3 Jordan Creek [AU# 14-34-4-(2)]**

##### *Current Status and 2003 Recommendations*

Jordan Creek at US 401 in Scotland County has the same bioclassification as in 1996 and currently is Supporting based on a Good-Fair bioclassification at site B-4. However, the stream appears to be channelized at the US 401 bridge and sand has filled in many of the pools. A lack of good instream habitat was also noted in the 2001 assessment, thus, resulting in a benthic macroinvertebrate abundance decline. DWQ will continue to monitor this site to determine if there are any long-term changes in water quality.

#### **6.4.4 Upper Beaverdam Creek [AU# 14-32-9]**

##### *Current Water Quality Initiative*

NC Wildlife Resources Commission received a \$46,000 grant from the CWMTF to acquire 100 acres along Upper Beaverdam Creek. See page 152 for project description.

#### **6.4.5 Panther Swamp/Bear Creek, Wilkinson Creek and Mitchell Swamp**

##### *Current Water Quality Initiatives*

Panther Swamp/Bear Creek, Wilkinson Creek and Mitchell Swamp watersheds comprise three of 20 watersheds in the Lumber River basin that have been identified by the NC Wetlands Restoration Program (NCWRP) as an area with the greatest need and opportunity for stream and wetland restoration efforts. This watershed will be given higher priority than nontargeted watersheds for the implementation of NCWRP restoration projects. Refer to page 147 in Section C for more information.

### **6.5 Additional Water Quality Issues within Subbasin 03-07-55**

This section discusses issues that may threaten water quality in the subbasin that are not specific to particular streams, lakes or reservoirs. The issues discussed may be related to waters near certain land use activities or within proximity to different pollution sources.

Most of the streams in this subbasin that are not already Impaired from urban stormwater runoff are threatened by development pressure throughout this subbasin. In order to prevent aquatic habitat degradation and impaired biological communities, protection measures must be put in place immediately. Refer to page 73 for a description of urban stream water quality problems and recommendations for reducing impacts to and restoring water quality in these waters.

## Section B - Chapter 7

### Lumber River Subbasin 03-07-56

#### Lake Waccamaw, Big Creek, Upper Waccamaw River and Bogue Swamp

## 7.1 Subbasin Overview

### ***Subbasin 03-07-56 at a Glance***

#### **Land and Water Area**

Total area:	216 mi <sup>2</sup>
Land area:	202 mi <sup>2</sup>
Water area:	14 mi <sup>2</sup>

#### **Population Statistics**

2000 Est. Pop.: 10,959 people

#### **Land Cover (percent)**

Forest/Wetland:	79
Surface Water:	7
Urban:	1
Agriculture:	13

#### **Counties**

Bladen and Columbus

#### **Municipalities**

Bolton and Lake Waccamaw

Land use in this subbasin is primarily forested and agriculture with some developed areas around Lake Waccamaw. Portions of Bladen and Columbus counties are located in this subbasin. All tributary streams tend to be intermittent with little or no flow during summer months. This pattern is related to the poorly drained soils of the region with little storage of groundwater.

There are 1,732 acres of managed public lands in this subbasin associated with the Lake Waccamaw State Park. Lake Waccamaw is the largest natural bay lake in southeastern North Carolina and is widely considered to be one of the most unique lakes in southeastern United States. The shallow, clear, high water quality and limestone bluffs along Lake Waccamaw's north shore neutralizes the lake's water and provides a unique habitat for a very diverse aquatic community such as endemic fish and mollusk species. In 2000, Lake Waccamaw was designated an Outstanding Resource Water (see page 36, regarding surface water classifications). The Town of Lake Waccamaw, in conjunction with Friends of Lake

Waccamaw State Park, has received a Section 319 grant to reduce nonpoint source impacts to the lake (refer to Section C for more information).

There are two NPDES wastewater discharge permits in this subbasin with a total permitted flow of 0.4 MGD. Refer to Appendix I for identification and more information on individual NPDES permit holders. There are six registered swine operations in this subbasin.

Three benthic macroinvertebrate community sites were sampled (Figure B-7 and Table B-13) in 2001 as part of basinwide monitoring. Both sites on Friar Swamp were Not Rated, as biocriteria were being developed (page 57) to assess these swampy streams. Lakes assessment was also conducted in 2001 on Lake Waccamaw as part of basinwide monitoring. Data showed mesotrophic to oligotrophic conditions, with generally low to moderate nutrient concentrations for the lake. Data were also collected from one ambient station. Refer to the 2002 *Lumber River Basinwide Assessment Report* at <http://www.esb.enr.state.nc.us/bar.html> and Section A, Chapter 3 for more information on monitoring.

Figure B-7 Lumber River Subbasin 03-07-56

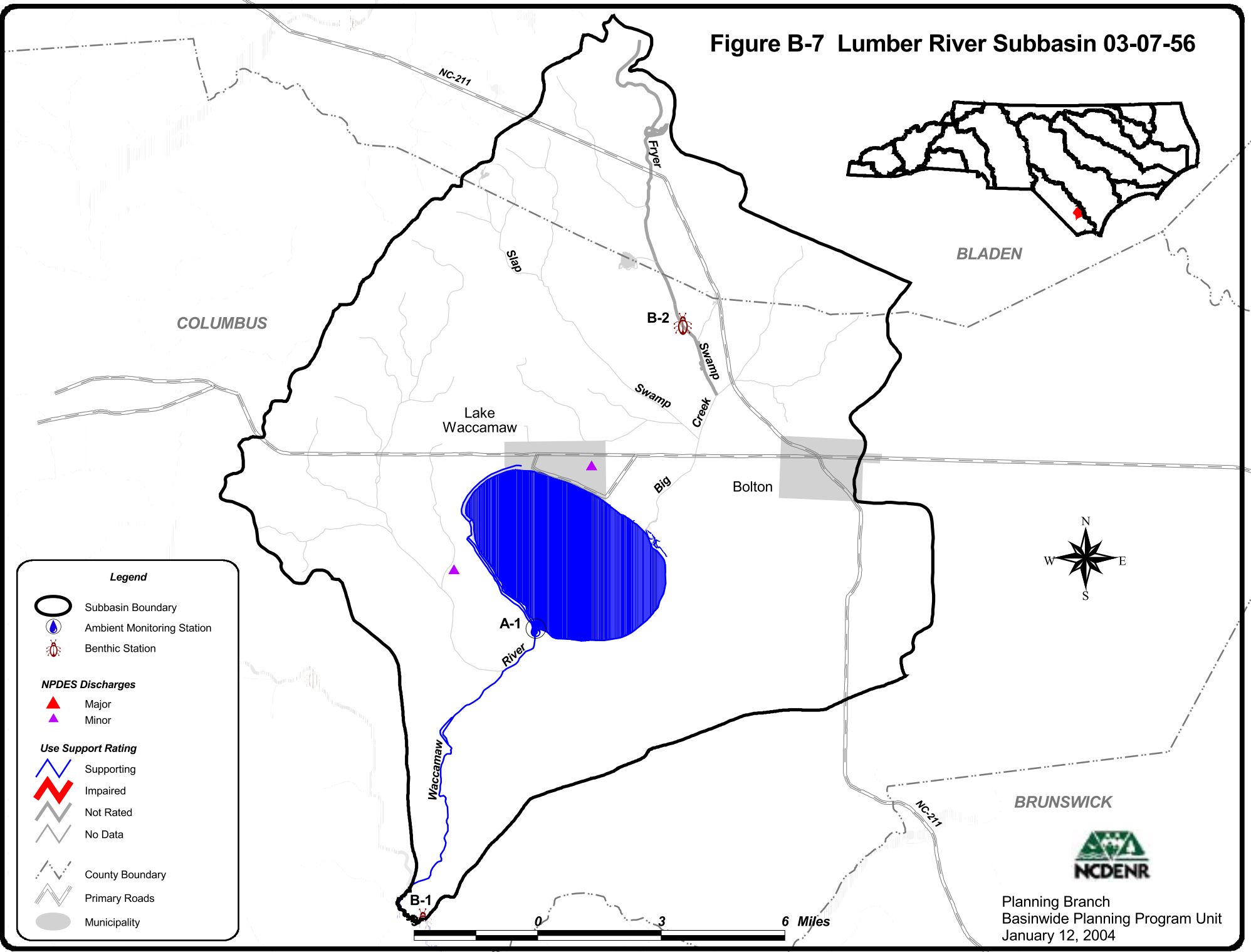




Table B-13 DWQ Monitoring Locations, Bioclassifications and Notable Chemical Parameters (1996-2001) for Subbasin 03-07-56

<b>Benthic Macroinvertebrate Community Monitoring Sites</b>					
<b>Site<sup>1</sup></b>	<b>Waterbody</b>	<b>County</b>	<b>Location</b>	<b>1996</b>	<b>2001</b>
B-1	Waccamaw River <sup>2</sup>	Columbus	SR 1928	--	Good
B-2	Friar Swamp	Columbus	SR 1740	Not Rated	Not Rated
SB-1	Friar Swamp	Columbus	SR 1740	Not Rated (1997-1999)	--
<b>Ambient Monitoring Sites</b>					
<b>Site<sup>1</sup></b>	<b>Waterbody</b>	<b>County</b>	<b>Location</b>	<b>Station #</b>	<b>Noted Parameters<sup>3</sup></b>
A-1	Waccamaw River	Columbus	Dam spillway	I7730000	None

<sup>1</sup> B = benthic macroinvertebrates; SB = benthic macroinvertebrates special study site; A = ambient monitoring station.

<sup>2</sup> Historical data available at this site. Refer to Appendix II.

<sup>3</sup> Parameters are noted if in excess of state standards in greater than 10 percent of all samples.

Use support ratings are summarized in Part 7.2 below. Recommendations, current status and future recommendations for waters that were Impaired in 1999 and newly Impaired waters are discussed in Part 7.3 below. Supporting waters with noted water quality impacts are discussed in Part 7.4 below. Water quality issues related to the entire subbasin are discussed in Part 7.5. Refer to Appendix III for use support methods and more information on all monitored waters.

## 7.2 Use Support Summary

Use support ratings (page 47) in subbasin 03-07-56 were assigned for aquatic life, recreation and fish consumption categories. All waters in the subbasin are considered Impaired on an evaluated basis because of a fish consumption advice (page 59). Refer to Table B-14 for a summary of use support ratings by category for waters in the subbasin.

Table B-14 Summary of Use Support Ratings by Use Support Category in Subbasin 03-07-56

Use Support Rating	Basis	Aquatic Life	Fish Consumption	Recreation
Supporting	Monitored	10.5 mi 8,840.2 ac	0	8,840.2 ac
	All Waters	10.5 mi 8,840.2 ac	0	8,840.2 ac
Impaired	Monitored	0	0	0
	All Waters	0	98.0 mi 8,840.2 ac	0
Not Rated	Monitored	12.0 mi	0	0
No Data	N/A	75.9 mi	0	98.0 mi 0 ac
Total	Monitored	22.1 mi 8,840.2 ac	0	8,840.2 ac
	All Waters	98.0 mi 8,840.2 ac	98.0 mi 8,840.2 ac	98.0 mi 8,840.2 ac
	Percent Monitored	22.6% mi 100% ac	0%	100% ac

Note: All waters include monitored, evaluated and waters that were not assessed.

### 7.3 Status and Recommendations of Previously and Newly Impaired Waters

There were no Impaired streams identified in the 1999 Lumber River Basinwide Plan in this subbasin. All waters in the subbasin are considered Impaired on an evaluated basis because of a fish consumption advice (page 59). There are no other newly Impaired waters in subbasin 03-07-56. Refer to Part 7.5 below for information on waters with noted water quality impacts.

### 7.4 Status and Recommendations for Waters with Noted Impacts

The surface waters discussed in this section are not Impaired. However, notable water quality problems and concerns have been documented for some waters based on this assessment. Attention and resources should be focused on these waters to prevent additional degradation or facilitate water quality improvement.

Waters in the following section are identified by assessment unit number (AU#). This number is used to track defined segments in the water quality assessment database and the 303(d) Impaired waters list. The assessment unit number is a subset of the DWQ index number (classification identification number). A letter attached to the end of the AU# indicates that the assessment is smaller than the DWQ index segment. No letter indicates that the assessment unit and the DWQ index segment are the same.

#### **7.4.1 Upper Waccamaw River [AU# 15-(1)c]**

##### *Current Status and 2003 Recommendations*

Upper Waccamaw River at SR 1928 in Columbus County is currently Supporting based on a Good bioclassification from the B-1 site. Habitat degradation (page 62) was noted with bank erosion, breaks in riparian zones and de-snagging efforts. When last sampled prior to this assessment in 1991, this site received an Excellent bioclassification. DWQ will continue to monitor this segment to determine if this decline is due to a change in water quality or due to hurricane-related changes in habitat.

##### *Current Water Quality Initiatives*

The Upper Waccamaw River watershed comprises one of 20 watersheds in the Lumber River basin that has been identified by the NC Wetlands Restoration Program (NCWRP) as an area with the greatest need and opportunity for stream and wetland restoration efforts. This watershed will be given higher priority than nontargeted watersheds for the implementation of NCWRP restoration projects. Refer to page 147 in Section C for more information.

#### **7.4.2 Lake Waccamaw [AU# 15-2]**

##### *Current Water Quality Initiatives*

The Town of Lake Waccamaw received a \$4,500,000 grant from the CWMTF to construct a stormwater retention system. See page 152 for project description. Lake Waccamaw has also been funded a \$588,000 State Revolving Loan for new collection lines.

#### **7.4.3 Friar Swamp [AU# 15-2-6-3]**

##### *Current Status and 2003 Recommendations*

Friar Swamp is currently Not Rated. An unnamed tributary of Friar Swamp was impacted by discharge of animal wastewater from a sprayfield operation. The owner was assessed a civil penalty. DWQ will continue to inspect this operation.

### **7.5 Additional Water Quality Issues within Subbasin 03-07-56**

This section discusses issues that may threaten water quality in the subbasin that are not specific to particular streams, lakes or reservoirs. The issues discussed may be related to waters near certain land use activities or within proximity to different pollution sources.

Many streams in the subbasin have noted impacts from the recent hurricanes. The biological community in the streams can recover rapidly if instream habitat is maintained. De-snagging operations should carefully remove debris from stream channels to restore natural flow and leave enough instream habitats so the biological community can recover. For more information on this issue, refer to page 68.



## Section B - Chapter 8

### Lumber River Subbasin 03-07-57

#### Lower Waccamaw River

## 8.1 Subbasin Overview

### ***Subbasin 03-07-57 at a Glance***

#### **Land and Water Area**

Total area:	555 mi <sup>2</sup>
Land area:	552 mi <sup>2</sup>
Water area:	3 mi <sup>2</sup>

#### **Population Statistics**

2000 Est. Pop.: 37,457 people

#### **Land Cover (percent)**

Forest/Wetland:	74
Surface Water:	1
Urban:	<1
Agriculture:	25

#### **Counties**

Brunswick and Columbus

#### **Municipalities**

Carolina Shores, Calabash, Tabor City and Shallotte

This subbasin lies partially in Columbus and Brunswick counties with population growth concentrating primarily around Tabor City (population: 2,509) and Calabash. Land use in this subbasin is largely forest and agriculture. Most of the tributary streams tend to be intermittent with little or no flow during the summer months.

There are four NPDES wastewater discharge permits in this subbasin with a total permitted flow of 1.6 MGD. The largest is Tabor City WWTP which discharges 1.1 MGD to Grissett Swamp. Refer to Appendix I for identification and more information on individual NPDES permit holders. Brunswick County will be required to develop a stormwater program under Phase II (page 69). There are also 15 registered swine operations in this subbasin.

There were four benthic macroinvertebrate community sites sampled in 2001 as part of basinwide monitoring. One site received a Good bioclassification and was last sampled in 1991. One site increased in bioclassification, and one site was Not Rated, as biocriteria were being

developed (page 57) to assess these swampy streams. There were two special study sites (SB-1 and SF-1) collected in the subbasin during the assessment period and were Not Rated as biocriteria are being developed. Data were also collected from three ambient monitoring stations. Refer to Figure B-8 and Table B-15 for locations and summaries of these monitoring sites. Refer to the 2002 *Lumber River Basinwide Assessment Report* at <http://www.esb.enr.state.nc.us/bar.html> and Section A, Chapter 3 for more information on monitoring.

Figure B-8 Lumber River Subbasin 03-07-57

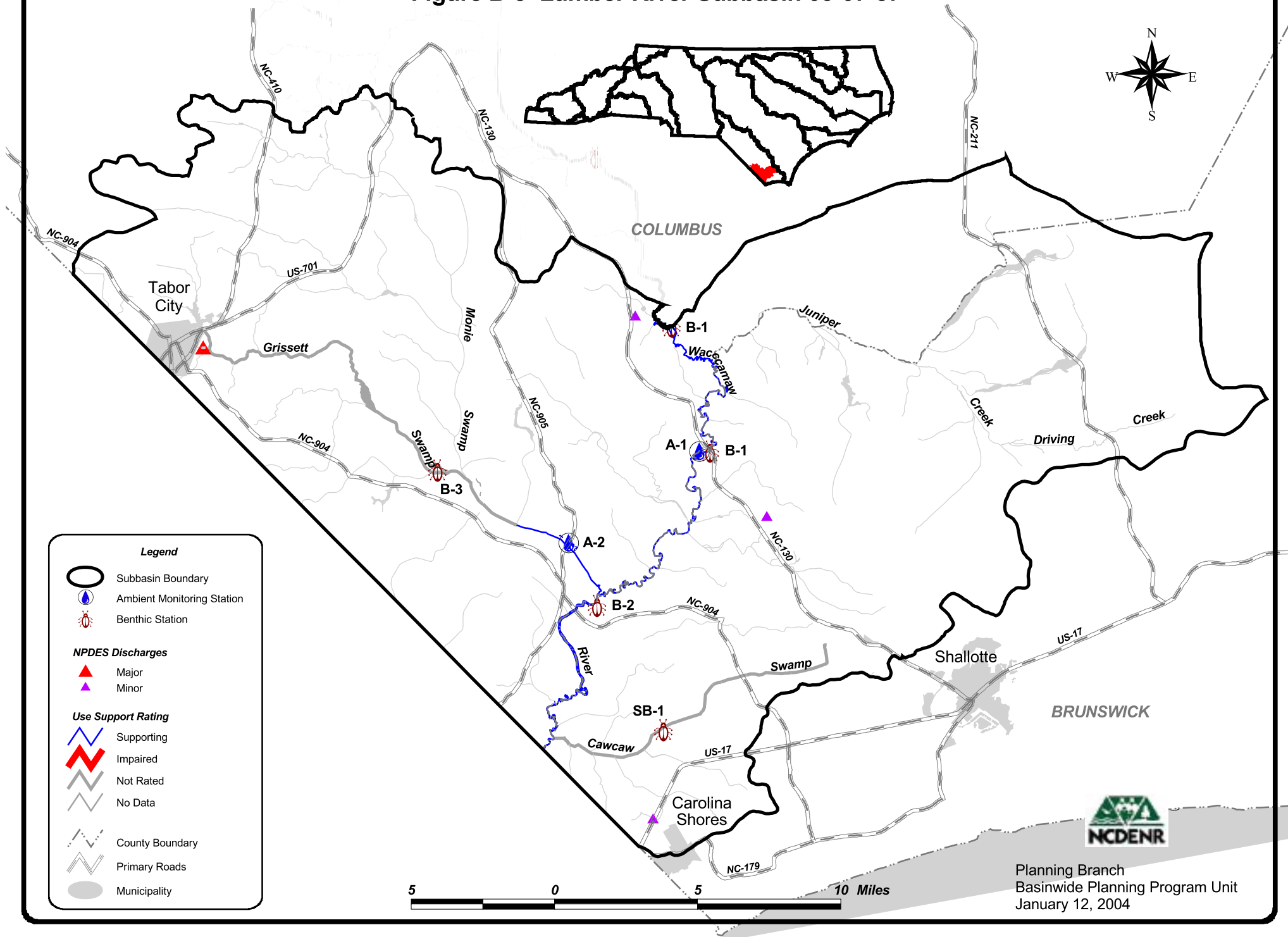


Table B-15 DWQ Monitoring Locations, Bioclassifications and Notable Chemical Parameters (1996-2001) for Subbasin 03-07-57

<b>Benthic Macroinvertebrate Community Monitoring Sites</b>					
<b>Site<sup>1</sup></b>	<b>Waterbody</b>	<b>County</b>	<b>Location</b>	<b>1996</b>	<b>2001</b>
B-1	Waccamaw River <sup>2</sup>	Columbus	NC 130	Good-Fair	Good
B-2	Waccamaw River <sup>2</sup>	Columbus	NC 904	--	Good
B-3	Grissett Swamp	Columbus	SR 1141	--	Not Rated
SB-1	Caw Caw Swamp	Brunswick	SR 1305	Not Rated	Not Rated
<b>Fish Community Monitoring Sites</b>					
<b>Site<sup>1</sup></b>	<b>Waterbody</b>	<b>County</b>	<b>Location</b>	<b>1996</b>	<b>2001</b>
SF-1	Seven Creek	Columbus	NC 905		Not Rated
<b>Ambient Monitoring Sites</b>					
<b>Site<sup>1</sup></b>	<b>Waterbody</b>	<b>County</b>	<b>Location</b>	<b>Station #</b>	<b>Noted Parameters<sup>3</sup></b>
A-1	Waccamaw River	Columbus	NC 130	I8970000	None
A-2	Seven Creek	Columbus	NC 905	I9310000	None
A-3*	Waccamaw River	Horry SC	SC 9 near Longs SC	I9350000	None

<sup>1</sup> B = benthic macroinvertebrates; SB = benthic macroinvertebrates special study site; SF = fish community special study site; and A = ambient monitoring station.

<sup>2</sup> Historical data available at this site. Refer to Appendix II.

<sup>3</sup> Parameters are noted if in excess of state standards in greater than 10 percent of all samples.

\* Not shown on map.

Use support ratings are summarized in Part 8.2 below. Recommendations, current status and future recommendations for waters that were Impaired in 1999 and newly Impaired waters are discussed in Part 8.3 below. Water quality issues related to specific waterbodies with noted impacts are discussed in Part 8.4. Water quality issues related to the entire subbasin are discussed in Part 8.5. Refer to Appendix III for use support methods and more information on all monitored waters.

## 8.2 Use Support Summary

Use support ratings (page 47) in subbasin 03-07-57 were assigned for aquatic life, recreation and fish consumption categories. All waters in the subbasin are considered Impaired on an evaluated basis because of a fish consumption advice (page 59). Refer to Table B-16 for a summary of use support ratings by category for waters in the subbasin.

Table B-16 Summary of Use Support Ratings by Use Support Category in Subbasin 03-07-57

Use Support Rating	Basis	Aquatic Life	Recreation	Fish Consumption
Supporting	Monitored	41.2 mi	32.3 mi	0
	All Waters	41.2 mi	32.3 mi	0
Impaired	Monitored	0	0	0
	All Waters	0	0	358.7 mi
Not Rated	Monitored	33.1 mi	0	0
No Data	N/A	284.3 mi	326.3 mi	0
Total	Monitored	74.4 mi	32.3 mi	0
	All Waters	358.7 mi	358.7 mi	358.7 mi
	Percent Monitored	20.7%	9.0%	0%

Note: All waters include monitored, evaluated and waters that were not assessed.

### 8.3 Status and Recommendations of Previously and Newly Impaired Waters

There were no Impaired streams identified in the 1999 Lumber River Basinwide Plan in this subbasin. All waters in the subbasin are considered Impaired on an evaluated basis because of a fish consumption advice (page 59). There are no other newly Impaired waters in subbasin 03-07-57.

### 8.4 Status and Recommendations for Waters with Noted Impacts

The surface waters discussed in this section are not Impaired. However, notable water quality problems and concerns have been documented for some waters based on this assessment. Attention and resources should be focused on these waters to prevent additional degradation or facilitate water quality improvement.

Waters in the following section are identified by assessment unit number (AU#). This number is used to track defined segments in the water quality assessment database and the 303(d) Impaired waters list. The assessment unit number is a subset of the DWQ index number (classification identification number). A letter attached to the end of the AU# indicates that the assessment is smaller than the DWQ index segment. No letter indicates that the assessment unit and the DWQ index segment are the same.



#### **8.4.1 Lower Waccamaw River [AU# 15-(1)e]**

##### *Current Status and 2003 Recommendations*

Waccamaw River at NC 130 and NC 904 in Columbus County is currently Supporting based on Good bioclassifications at sites B-1 and B-2. However, habitat degradation was noted with steep and severely eroded riverbanks. DWQ will continue to monitor water quality in the river to evaluate possible impacts.

Although, the Waccamaw River is currently Not Impaired in North Carolina, it is Impaired in South Carolina for dissolved oxygen, copper and mercury. Consequently, in the future, North Carolina would be subject to an interstate TMDL. DWQ will work cooperatively with South Carolina as they develop a TMDL for the Lower Waccamaw River.

##### *Current Water Quality Initiatives*

In 2000, the North Carolina Coastal Land Trust prepared a riparian corridor conservation design for the Conservation Trust for North Carolina and the NC Clean Water Management Trust Fund. The goal of the design is to protect 59 miles of existing riparian buffers along the Waccamaw River and Juniper Creek. The NC Wildlife Resources Commission received a \$9,000,000 grant from the CWMTF for acquiring 2,530 acres along the Waccamaw River and Juniper Creek. See page 152 for project description.

#### **8.4.2 Grissett Swamp [AU# 15-17-1-(5)]**

##### *Current Status and 2003 Recommendations*

Grissett Swamp is currently Not Rated. Tabor City WWTP experienced noncompliance issues with fecal coliform bacteria, ammonia, biochemical oxygen demand and toxicity test failures in this assessment period. In the spring of 2001, the facility completed a SOC. DWQ staff continues to work with the facility.

##### *Current Water Quality Initiatives*

As of August 2002, Tabor City received a State Revolving Grant of \$3,000,000 to extend their wastewater lines to the Waccamaw River. However, other alternatives are being investigated and a final solution has not been determined. As of December 2002, Tabor City WWTP received a \$570,000 grant from the CWMTF for wastewater improvements. See page 152 for project description.

#### **8.4.3 Bear Branch [AU# 15-11]**

##### *Current Status and 2003 Recommendations*

The Waccamaw Elementary School-Brunswick County experienced noncompliance issues with fecal coliform bacteria and ammonia. As of May 2003, the facility's noncompliance problems have not been resolved. DWQ continues to work with the facility to rectify the problems.

#### **8.4.4 Leonard Branch [AU# 15-7-4]**

##### *Current Status and 2003 Recommendations*

Leonard Branch, a tributary of Juniper Creek, was impacted by discharge of animal wastewater from a sprayfield operation. The owner was assessed a civil penalty. DWQ will continue to inspect this operation.

#### **8.4.5 Big Branch [AU# 15-17-1-12-1-1]**

##### *Current Status and 2003 Recommendations*

Big Branch, a tributary of Beaver Dam Swamp, was impacted by discharge of animal wastewater from a sprayfield operation. The owner was assessed a civil penalty. DWQ will continue to inspect this operation.

#### **8.4.6 Juniper Swamp, Upper Waccamaw River, Middle Waccamaw River, Gore Creek and Big Creek**

##### *Current Water Quality Initiatives*

Juniper Swamp, Upper Waccamaw River, Middle Waccamaw River, Gore Creek and Big Creek watersheds comprise five of 20 watersheds in the Lumber River basin that have been identified by the NC Wetlands Restoration Program (NCWRP) as an area with the greatest need and opportunity for stream and wetland restoration efforts. This watershed will be given higher priority than nontargeted watersheds for the implementation of NCWRP restoration projects. Refer to page 147 in Section C for more information.

### **8.5 Additional Water Quality Issues within Subbasin 03-07-57**

This section discusses issues that may threaten water quality in the subbasin. The issues discussed may be related to waters near certain land use activities or within proximity to different pollution sources.

#### **8.5.1 Impacts of Post-Hurricane De-Snagging on Instream Habitats (Monie Swamp)**

Many streams in the subbasin have noted impacts from the recent hurricanes. Monie Swamp was not sampled during this assessment period because de-snagging efforts eliminated much of the important habitat for aquatic fauna. The biological community in the streams can recover rapidly if instream habitat is maintained. De-snagging operations should carefully remove debris from stream channels to restore natural flow and leave enough instream habitats so the biological community can recover. For more information on this issue, refer to page 68.

#### **8.5.2 Green Swamp**

A proposed 100-acre landfill by Reigel Ridge LLC in the Green Swamp near the Columbus and Brunswick County line has been a very contentious issue for local residents and environmental groups. One primary concern is that a portion of the landfill would be constructed in the

floodplain causing potential impacts (leachate) to groundwater and surface water. As of September 2003, the Division of Solid Waste Management returned the application to Reigel Ridge LLC for failure to provide sufficient financial information.

### **8.5.3 Golf Courses (Caw Caw Swamp, Calabash River)**

The number of golf courses in Brunswick County has expanded so vastly over the last five years making many of the small towns centers for golfing activity. Utilizing best management practices during and after construction of the courses can greatly reduce nonpoint source pollution to adjacent streams. It is critical to implement and maintain these management practices throughout the life of the golf course. See page 78 for more information.



## Section B - Chapter 9

### Lumber River Subbasin 03-07-58

#### White Marsh

## 9.1 Subbasin Overview

### ***Subbasin 03-07-58 at a Glance***

#### **Land and Water Area**

Total area:	308 mi <sup>2</sup>
Land area:	306 mi <sup>2</sup>
Water area:	2 mi <sup>2</sup>

#### **Population Statistics**

2000 Est. Pop.: 15,281 people

#### **Land Cover (percent)**

Forest/Wetland:	62
Surface Water:	1
Urban:	1
Agriculture:	37

#### **Counties**

Bladen and Columbus

#### **Municipalities**

Brunswick, Chadbourn, Clarkton  
and Whiteville

Population growth in the subbasin is concentrated around Chadbourn and Whiteville. Land use in the subbasin is mostly forest and agriculture areas. Most streams have a braided channel, a wide floodplain with little or no flow during the summer months.

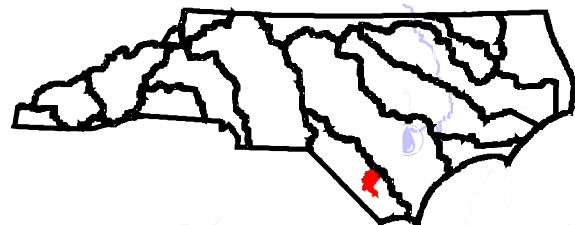
There are six NPDES wastewater discharge permits in this subbasin with a total permitted flow of 4.27 MGD. The largest NPDES facility is Whiteville WWTP which discharges 3.0 MGD to White Marsh. Refer to Appendix I for identification and more information on individual NPDES permit holders. There are also 34 registered swine operations in this subbasin.

There were two benthic macroinvertebrate community sites sampled (Figure B-9 and Table B-17) in 2001 as part of basinwide monitoring. Both sites were Not Rated, as biocriteria were being developed (page 57) to assess these swampy streams. There are no ambient monitoring stations located in this subbasin. Refer to the 2002 *Lumber River Basinwide Assessment Report* at <http://www.esb.enr.state.nc.us/bar.html> and Section A, Chapter 3

for more information on monitoring.

Use support ratings are summarized in Part 9.2 below. Recommendations, current status and future recommendations for waters that were Impaired in 1999 and newly Impaired waters are discussed in Part 9.3 below. Water quality issues related to specific waterbodies with noted impacts are discussed in Part 9.4. Refer to Appendix III for use support methods and more information on all monitored waters.

**Figure B-9 Lumber River Subbasin 03-07-58**



**Legend**

- Subbasin Boundary
- Benthic Station
- NPDES Discharges**
  - Major
  - Minor
- Use Support Rating**
  - Supporting
  - Impaired
  - Not Rated
  - No Data
- County Boundary
- Primary Roads
- Municipality



Planning Branch  
Basinwide Planning Program Unit  
January 12, 2004

ROBESON

BLADEN

COLUMBUS



Chadbourn

Soules

Whiteville

Swamp

Brunswick

Clarkton

Elkton

B-2

Marsh

B-1

Marsh

Marsh

Brown

Swamp

White

NC-410

NC-242

US-701

NC-211

NC-410

US-701

NC-130

NC-905

Table B-17 DWQ Benthic Macroinvertebrate Monitoring Locations and Bioclassifications (1996-2001) for Subbasin 03-07-58

Benthic Macroinvertebrate Community Monitoring Sites					
Site <sup>1</sup>	Waterbody	County	Location	1996	2001
B-1	White Marsh	Columbus	SR 1001	--	Not Rated
B-2	Elkton Marsh	Bladen	SR 1710	Not Rated	Not Rated

<sup>1</sup> B = benthic macroinvertebrates

## 9.2 Use Support Summary

Use support ratings (page 47) in subbasin 03-07-58 were assigned for aquatic life, recreation and fish consumption categories. All waters in the subbasin are considered Impaired on an evaluated basis because of a fish consumption advice (page 59). Refer to Table B-18 for a summary of use support ratings by category for waters in the subbasin.

Table B-18 Summary of Use Support Ratings by Use Support Category in Subbasin 03-07-58

Use Support Rating	Basis	Aquatic Life	Recreation	Fish Consumption
Supporting	Monitored	0	0	0
	All Waters	0	0	0
Impaired	Monitored	0	0	0
	All Waters	0	0	220.5 mi
Not Rated	Monitored	18.0 mi	0	0
No Data	N/A	202.5 mi	220.5 mi	0
Total	Monitored	18.0 mi	0	0
	All Waters	220.5 mi	220.5 mi	220.5 mi
	Percent Monitored	8.2%	0%	0%

Note: All waters include monitored, evaluated and waters that were not assessed.

## 9.3 Status and Recommendations of Previously and Newly Impaired Waters

There were no Impaired streams identified in the 1999 Lumber River Basinwide Plan in this subbasin. All waters in the subbasin are considered Impaired on an evaluated basis because of a fish consumption advice (page 59). There are no other newly Impaired waters in subbasin 03-07-58.

## **9.4 Status and Recommendations for Waters with Noted Impacts**

The surface waters discussed in this section are not Impaired. However, notable water quality problems and concerns have been documented for some waters based on this assessment. Attention and resources should be focused on these waters to prevent additional degradation or facilitate water quality improvement.

Waters in the following section are identified by assessment unit number (AU#). This number is used to track defined segments in the water quality assessment database and the 303(d) Impaired waters list. The assessment unit number is a subset of the DWQ index number (classification identification number). A letter attached to the end of the AU# indicates that the assessment is smaller than the DWQ index segment. No letter indicates that the assessment unit and the DWQ index segment are the same.

### **9.4.1 Soules Swamp [AU# 15-4-8]**

#### *Current Status and Water Quality Initiative*

Chadborn WWTP was experiencing noncompliance problems with BOD during the assessment period (1996-2001). The facility received a \$1,312,000 grant from the Clean Water Management Trust Fund and a new plant has been constructed. To date, the facility has been in compliance.

### **9.4.2 Horseshoe Swamp [AU# 15-4-1-1-2-2]**

#### *Current Status and 2003 Recommendations*

Horseshoe Swamp was impacted by discharge of animal wastewater from a sprayfield operation. The owner was assessed a civil penalty. DWQ will continue to inspect this operation.

### **9.4.3 Elkton Marsh [AU# 15-4-1-1-2]**

#### *Current Status and 2003 Recommendations*

Elkton Marsh is currently Not Rated. An unnamed tributary of Elkton Marsh was impacted by discharge of animal wastewater from a sprayfield operation. The owner was assessed a civil penalty. DWQ will continue to inspect this operation.

### **9.4.4 Brown Marsh Swamp [AU# 15-4-1-1-1]**

#### *Current Status and 2003 Recommendations*

An unnamed tributary of Brown Marsh Swamp was impacted by discharge of animal wastewater from a sprayfield operation. The owner was assessed a civil penalty. DWQ will continue to inspect this operation.

### **9.4.5 White Marsh [AU# 15-4a, b & c]**

#### *Current Water Quality Initiative*

The Nature Conservancy received a total of \$374,000 in grants from the CWMF to acquire 517 acres along White Marsh. See page 152 for project descriptions.



## Section B - Chapter 10

### Lumber River Subbasin 03-07-59

#### Lockwoods Folly and Shallotte Rivers

### 10.1 Subbasin Overview

#### ***Subbasin 03-07-59 at a Glance***

##### **Land and Water Area**

Total area:	267 mi <sup>2</sup>
Land area:	260 mi <sup>2</sup>
Water area:	7 mi <sup>2</sup>

##### **Population Statistics**

2000 Est. Pop.: 21,177 people

##### **Land Cover (percent)**

Forest/Wetland:	75%
Surface Water:	3%
Urban:	4%
Agriculture:	18%

##### **Counties**

Brunswick

##### **Municipalities**

Boiling Spring Lakes, Bolivia,  
Carolina Shores, Holden Beach,  
Oak Island, Ocean Isle Beach,  
Shallotte, Sunset Beach and  
Varnumtown

This subbasin is entirely located in Brunswick County and is the only subbasin in the entire Lumber River basin where all waters drain to the Atlantic Ocean. Population growth in the subbasin is primarily concentrated in the coastal communities but also around the towns of Shallotte and Calabash. Brunswick County has the highest estimated population change for the 2000-2020 year projection of 39,742 (refer to Table A-5, Section A for further information).

There are three NPDES wastewater discharge permits in this subbasin with a total permitted flow of 0.02 MGD. There is also one individual NPDES stormwater permit in the subbasin. Brunswick County and South Brunswick Water and Sewer Authority are required to develop a stormwater program under Phase II (page 69). There is also one registered swine operation in this subbasin.

There were three benthic macroinvertebrate community sites sampled in 2001 as part of basinwide monitoring. One site was Not Rated, as biocriteria were being developed (page 57) to assess swamp streams. Another site received a Fair bioclassification, and the last benthic site sampled was part of a special study investigation.

There was one fish community site sampled and was Not Rated due to biocriteria still in development. Data were also collected from 13 ambient stations. See Figure B-10 and Table B-19 for locations and summaries of data from these monitoring sites. Refer to the *2002 Lumber River Basinwide Assessment Report* at <http://www.esb.enr.state.nc.us/bar.html> and Section A, Chapter 3 for more information on monitoring.

The Division of Environmental Health Shellfish Sanitation and Recreational Water Quality Section (page 45) has classified 674 acres as approved, 1,426 acres as conditionally approved-open, 711 acres as conditionally approved-closed, and 1,469 acres as prohibited/restricted.

Figure B-10 Lumber River Subbasin 03-07-59

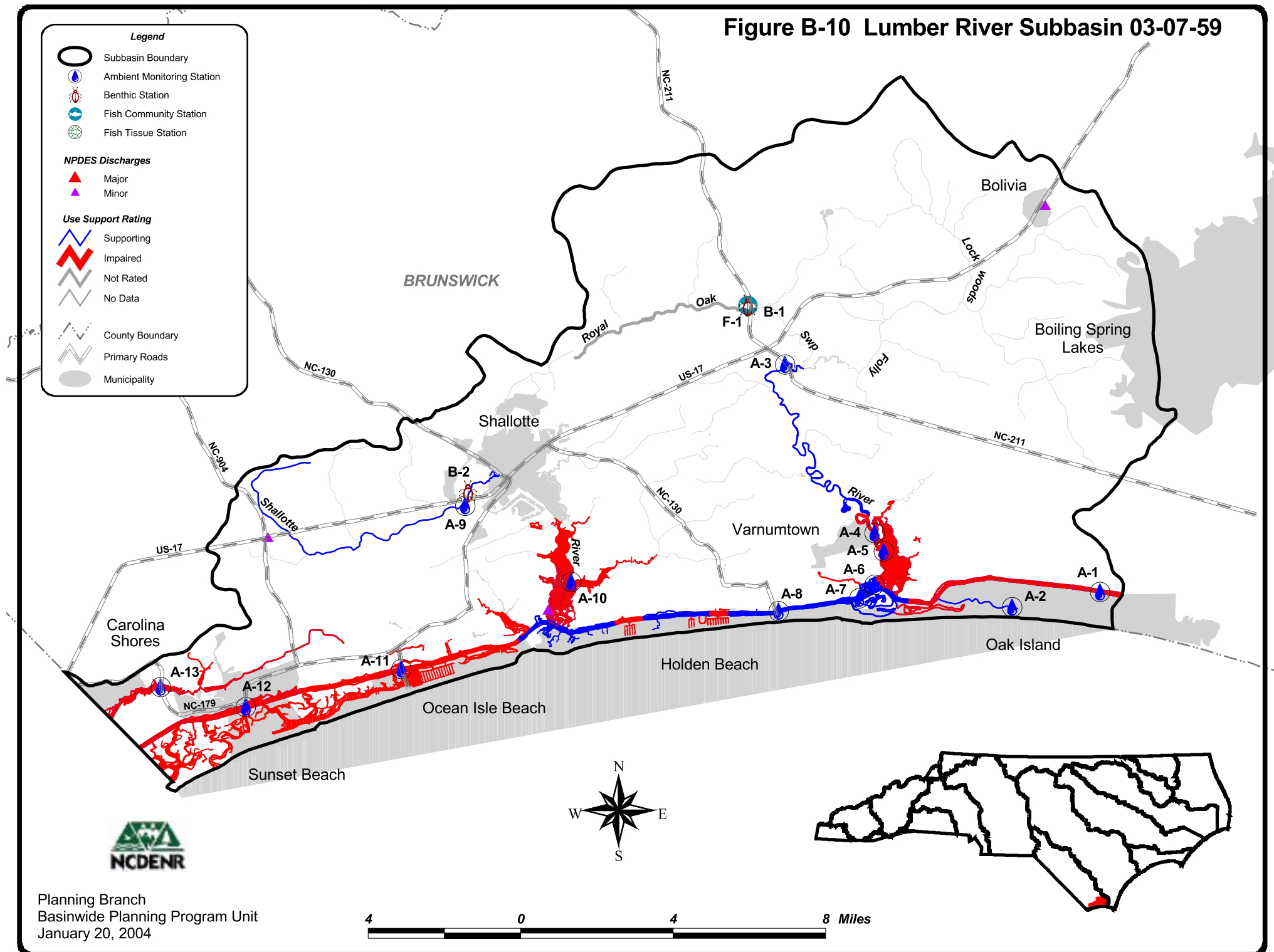


Table B-19 DWQ Monitoring Locations, Bioclassifications and Notable Chemical Parameters (1996-2001) for Subbasin 03-07-59

<b>Benthic Macroinvertebrate Community Monitoring Sites</b>					
<b>Site<sup>1</sup></b>	<b>Waterbody</b>	<b>County</b>	<b>Location</b>	<b>1996</b>	<b>2001</b>
B-1	Royal Oak Swamp	Brunswick	NC 211	Good-Fair	Not Rated
B-2	Shallotte River <sup>2</sup>	Brunswick	Near US 17	Good-Fair	Fair Good-Fair (resample 2003)
SB-1	Royal Oak Swamp	Brunswick	NC 211	Not Rated (1998)	Not Rated (1999)
<b>Fish Community Monitoring Sites</b>					
<b>Site<sup>1</sup></b>	<b>Waterbody</b>	<b>County</b>	<b>Location</b>	<b>1996</b>	<b>2001</b>
F-1	Royal Oak Swamp <sup>2</sup>	Brunswick	NC 211	--	Not Rated
<b>Ambient Monitoring Sites</b>					
<b>Site<sup>1</sup></b>	<b>Waterbody</b>	<b>County</b>	<b>Location</b>	<b>Station #</b>	<b>Noted Parameters<sup>3</sup></b>
A-1	Intracoastal Waterway	Brunswick	CM R16 at Beaverdam Creek	I9380000	None
A-2	Montgomery Slough	Brunswick	SR 1105	I9385000	Fecal coliform bacteria*
A-3	Lockwoods Folly River	Brunswick	NC 211	I9420000	None
A-4	Lockwoods Folly River	Brunswick	At Varnum	I9440000	Fecal coliform bacteria*
A-5	Lockwoods Folly River	Brunswick	CM R8 - downstream of Varnum	I9450000	Fecal coliform bacteria*
A-6	Lockwoods Folly River	Brunswick	West Channel Islands	I9500000	None
A-7	Intracoastal Waterway	Brunswick	CM R42 West of Lockwoods Folly River	I9510000	Fecal coliform bacteria*
A-8	Intracoastal Waterway	Brunswick	NC 130	I9530000	None
A-9	Shallotte River	Brunswick	Business US 17	I9700000	None
A-10	Shallotte River	Brunswick	At Shell Point	I9820000	None
A-11	Intracoastal Waterway	Brunswick	NC 904	I9840000	None
A-12	Intracoastal Waterway	Brunswick	SR 1172	I9880000	Fecal coliform bacteria*
A-13	Calabash Creek	Brunswick	NC 179	I9916000	pH, Fecal coliform bacteria*

\* Fecal coliform bacteria levels exceeded criteria for shellfish harvesting waters only.

<sup>1</sup> B = benthic macroinvertebrates; F = fish community; A = ambient monitoring station; SB = benthic macroinvertebrates special study site.

<sup>2</sup> Historical data available at this site. Refer to Appendix II.

<sup>3</sup> Parameters are noted if in excess of state standards in greater than 10 percent of all samples.

Use support ratings are summarized in Part 10.2 below. Recommendations, current status and future recommendations for waters that were Impaired in 1999 are discussed in Part 10.3 below. Current status and future recommendations for newly Impaired waters are discussed in Part 10.4 below. Supporting waters with noted water quality impacts are discussed in Part 10.5 below. Water quality issues related to the entire subbasin are discussed in Part 10.6. Refer to Appendix III for use support methods and more information on all monitored waters.

## **10.2 Use Support Summary**

Use support ratings (page 47) in subbasin 03-07-59 were assigned for aquatic life, recreation, fish consumption and shellfish harvesting categories. All waters in the subbasin are considered Impaired on an evaluated basis because of a fish consumption advice (page 59). Also 25.6 Atlantic coastline miles are Impaired in the fish consumption category based on fish tissue monitoring data.

Refer to Table B-20 for a summary of use support ratings by category for waters in the subbasin. Use support ratings for waters that were monitored and Impaired for the shellfish harvesting category in 1999 are presented in Table B-21. Use support ratings for specific waterbodies that were monitored and Impaired for the shellfish harvesting category in 2003 are presented in Table B-22 where these waters are identified by an assessment unit number (AU#). This number is used to track defined segments in the water quality assessment database and the 303(d) Impaired waters list. The assessment unit number is a subset of the DWQ index number (classification identification number). A letter attached to the end of the AU# indicates that the assessment is smaller than the DWQ index segment. No letter indicates that the assessment unit and the DWQ index segment are the same.

Table B-20 Summary of Use Support Ratings by Use Support Category in Subbasin 03-07-59

Use Support Rating	Basis	Aquatic Life	Fish Consumption	Recreation	Shellfish Harvesting
Supporting	Monitored	22.2 mi 2,170.0 Est. ac	0	22.2 mi 2,039.2 Est. ac 25.6 coast	673.9 Est. ac
	All Waters	22.2 mi 2,170.0 Est. ac	0	22.2 mi 2,039.2 Est. ac 25.6 coast	673.9 Est. ac
Impaired	Monitored	0	25.6 coast	0	3,607.0 Est. ac
	All Waters	0	146.5 mi 4305.6 Est. ac	0	3,607.0 Est. ac
Not Rated	Monitored	5.9 mi	0	0	0
No Data	N/A	118.4 mi 2,135.5 Est. ac	0	123.7 mi 2,267.3 Est. ac	0
Total	Monitored	28.1 mi 2,170.0 Est. ac	25.6 coast	22.2 mi 2,039.2 Est. ac 25.6 coast	4,280.8 Est. ac
	All Waters	146.5 mi 4,305.6 Est. ac 25.6 coast	146.5 mi 4,305.6 Est. ac 25.6 coast	146.5 mi 4,305.6 Est. ac 25.6 coast	4,280.8 Est. ac
	Percent Monitored	19.2% mi 50.4% Est. ac	100.0% coast	15.2% mi 47.4% Est. ac 100% coast	100%

Note: All waters include monitored, evaluated and waters that were not assessed.

Table B-21 Previously Impaired Shellfish Harvesting (SA) Waters in Subbasin 03-07-59

Name	1999 Status	Acres
Calabash (DEH Area A-1)	Partially Supporting	1,138
Shallotte River (DEH Area A-2)	Partially Supporting	571
Lockwoods Folly River (DEH Area A-3)	Partially Supporting	913
<b>Total 1999 Impaired Acres</b>		<b>2,622</b>

Table B-22 Currently Impaired Shellfish Harvesting (SA) Waters in Subbasin 03-07-59

Name	Assessment Unit Number	DEH Classification Status *	Acres
Portions of Intracoastal Waterway	15-25	CAO, PRO, CAC	2,118
Portions of Lockwoods Folly River	15-25-1-(16)	CAO, PRO, CAC	606.2
Portions of Shallotte River	15-25-1-(10)	CAO, PRO, CAC	647.3
Mullet Creek	15-25-1-19	PRO	5.7
Sams Branch	15-25-2-12-(2)	PRO	1
Spring Creek	15-25-1-21	PRO	2.4
Jinnys Branch	15-25-2-16-1-(2)	PRO	1
Kilbart Slough	15-25-4	PRO	0.7
Mill Creek	15-25-1-18-(2)	PRO	2
The Mill Pond	15-25-2-11-(2)	PRO	3
The Swash	15-25-2-14	CAO	3.9
Shallotte Creek	15-25-2-15-(3)	CAO	135.6
Saucepan Creek	15-25-2-16	PRO	62.6
Goose Creek	15-25-2-16-4-(2)	PRO	4.2
Calabash River	15-25-5	PRO	3.4
Hangman Branch	15-25-5-1	PRO	10.2
<b>Total 2003 Impaired Acres</b>			<b>3,606.9</b>

\* Division of Environmental Health Classifications: PRO = prohibited; COA = Conditionally Approved-Open; and CAC = Conditionally Approved Closed.

### 10.3 Status and Recommendations of Previously Impaired Waters

#### 10.3.1 Impaired Class SA Waters

Portions of Lockwoods Folly and Shallotte Rivers, Intracoastal Waterway and all of Calabash Creek were partially supporting in the 1999 basin plan because they were classified as prohibited and conditionally approved closed to shellfish harvesting by DEH SS (page 45). It was recommended that management strategies be developed for shellfish harvesting waters. These strategies included, but were not limited to, reducing NPS runoff, resolving septic system impacts, and working more closely with other state and local agencies to address all pollution impacts to SA waters. The differences in acreage estimates between years are not necessarily related to changes in water quality, but to different methods of estimating acreage and changes in use support methodology (Appendix III). These waters are discussed below in Part 10.4.1.

## **10.4 Status and Recommendations of Waters Newly Impaired Waters**

### **10.4.1 Portions of the Intracoastal Waterway, Lockwoods Folly River, Shallotte River, Mullet Creek, Sams Branch, Spring Creek, Jinnys Branch, Kilbart Slough, Mill Creek, The Mill Pond, The Swash, Shallotte Creek, Saucepan Creek, Goose Creek, Calabash River, Hangman Branch**

#### Current Status

Portions or all of these waters are currently Impaired (see Table B-22 for listing and acreages). These areas are prohibited, conditionally approved-closed or conditionally approved-open to shellfish harvesting because of bacteria levels (page 66) that do not meet approved area criteria. All waters in the subbasin are considered Impaired on an evaluated basis because of fish consumption advice (page 59).

#### 2003 Recommendations

DWQ, DEH SS and NC Coastal Nonpoint Source Program (refer to page 156) are developing the database and expertise necessary to assess shellfish harvesting use support using a frequency of closure based approach. This database will allow DWQ to better assess the extent and duration of closures in Class SA waters. These tools are not available for use support determinations in Class SA waters for the 2003 Lumber River basin assessment. DWQ believed it important to identify frequency of closures in these waters, resulting in an interim methodology to be used based on existing databases and GIS shapefiles. This will likely bring changes in reported acreages in future assessments using the permanent methods and tools that define areas and closure frequency.

For the 2003 Lumber River basin assessment, DWQ used an interim frequency of closures based method to assign use support ratings to Class SA waters. DWQ worked with DEH SS to determine the number of days and acreages that identified conditionally approved-open Class SA waters which were closed to shellfish harvesting in the Lumber River basin during the assessment period (September 1, 1996 to August 31, 2001). For the one growing area with conditionally approved-open (CAO) Class SA waters, DEH SS and DWQ staff defined subareas (within the larger conditionally approved-open area) that were opened and closed at the same time. The number of days these conditionally approved-open waters were closed was determined using proclamation summary sheets and the original proclamations. The number of days that approved areas in the growing area were closed due to preemptive closures because of named storms was not counted. DEH SS will continue to monitor bacteriological water quality in these waters. DWQ, DEH, DCM and DMF are currently developing tools to better track water quality changes, make use support decisions, and support research in shellfish harvesting waters of North Carolina (refer to Appendix III for more information).

DMF is in the process of developing Coastal Habitat Protection Plans (CHPP) with DWQ and DCM. These plans will identify existing and potential threats to habitats important to coastal fisheries and recommend actions to restore and protect them. The plans will also provide a framework for adoption of rules to protect habitats vital to coastal fisheries. The plans will help to assure consistent actions among the Coastal Resources Commission (CRC), Environmental Management Commission (EMC) and the Marine Fisheries Commission (MFC). For more

information on these plans, contact the Habitat Protection Section at (252) 726-7021 or visit the CHPP website at <http://www.ncfisheries.net/habitat/chpp1.htm>.

In November 1999, the Coastal Resources Commission (CRC) enacted rules designed to protect coastal waters. The rules require a 30-foot buffer for new development along coastal shorelines in the 20 CAMA counties. The new rules became effective in August 2000. Visit <http://dcm2.enr.state.nc.us/> for more information on these rules.

A Land Use Plan Review Team authorized by the CRC has recommended better implementation of land use plans and involvement of local governments in the basinwide planning process. In September 2000, the team provided the CRC with a set of recommendations to restructure the existing land use planning program. Since land use plans affect permit decisions, growth patterns and community visions, any revisions to the process can potentially have widespread impact to coastal decision-making and inevitably water quality. Therefore, DWQ will play an active role in land use planning discussions, especially with respect to water quality concerns (refer to page 145 for more information).

Local governments should consider water quality impacts in all aspects of government operations. Land use planning should discourage development in wetlands and areas draining to sensitive coastal areas. Land use plans should incorporate preservation and limited development of land adjacent to approved shellfish harvesting areas. Best management practices should be implemented during all land-disturbing activities to reduce runoff and delivery of bacterial contaminants to shellfish harvesting waters. Local governments with jurisdictions around the large areas of conditionally approved-open waters should work together with the DENR agencies to develop strategies for reducing sources and delivery of bacterial contaminants to these waters in an effort to reduce the extent and duration of temporary closures. A long-term strategy should be put in place to eventually restore shellfish harvesting to prohibited areas where human activities have caused these closures.

#### **10.4.2 Atlantic Ocean [AU# 99-(1)]**

##### *Current Status and 2002 Recommendations*

The Atlantic Ocean (25.6 coastline miles) is currently Impaired in the fish consumption category because there is a statewide consumption advice for mercury in fish tissue that is applied to waters east and south of I-85, including the Atlantic Ocean where king mackerel fish tissue was analyzed in 1999.

### **10.5 Status and Recommendations for Waters with Noted Impacts**

The surface waters discussed in this section are Supporting designated uses based on DWQ's use support assessment and are not considered to be Impaired unless otherwise noted. However, notable water quality problems and concerns have been documented for some waters based on this assessment. Attention and resources should be focused on these waters to prevent additional degradation or facilitate water quality improvement.

Waters in the following section are identified by assessment unit number (AU#). This number is used to track defined segments in the water quality assessment database and the 303(d) Impaired



waters list. The assessment unit number is a subset of the DWQ index number (classification identification number). A letter attached to the end of the AU# indicates that the assessment is smaller than the DWQ index segment. No letter indicates that the assessment unit and the DWQ index segment are the same.

### **10.5.1 Calabash River [AU# 15-25-5]**

#### *Current Status and 2003 Recommendations*

Calabash River is currently Impaired for shellfish harvesting. However, it is observed from the DWQ ambient monitoring station, I9916000, that the pH values (site A-13) were lower than 6.8 in 18.4 percent of the samples. The 10<sup>th</sup> percentile illustrates the value of the lower 10 percent of the measurements. The 10<sup>th</sup> percentile of pH was 6.7. The state's standard for saltwater is a range of 6.8 to 8.5. Possible adjacent swamp waters could be influencing this watershed. It was also observed at this ambient site that the fecal coliform values exceeded the geometric mean of 14/100 ml in more than 10 percent of the samples for class SA waters. See page 66 for more information. DWQ will continue to monitor this site.

#### *Current Water Quality Initiatives*

Calabash River watershed comprises one of 20 watersheds in the Lumber River basin that has been identified by the NC Wetlands Restoration Program (NCWRP) as an area with the greatest need and opportunity for stream and wetland restoration efforts. This watershed will be given higher priority than nontargeted watersheds for the implementation of NCWRP restoration projects. Refer to page 147 in Section C for more information.

South Brunswick Water and Sewer Authority received a \$3,000,000 State Revolving Grant for a new collection system. See page 145 for more information.

### **10.5.2 Shallotte River [AU# 15-25-2-(1)]**

#### *Current Status and 2003 Recommendations*

Site B-2 near US 17 was reduced from a Good-Fair bioclassification in 1996 to a Fair bioclassification during the 2001 assessment. The decrease in bioclassification was possibly due to drought conditions and subsequent affects of brackish intrusion during the low flow period. DWQ resampled this site in September 2003 to assess potential drought impacts. The site assessment in 2003 received a Good-Fair bioclassification. However, this assessment found the highest number of taxa out of its historical sampling regime including the freshwater/brackish shrimp, *Macrobrachium olfersii*. This crayfish-like species inhabits the transitional zones between fresh and brackish water and is rarely seen. This individual is only the second one found in North Carolina. The Shallotte River is currently rated Supporting for the aquatic life category.

#### *Current Water Quality Initiatives*

The Shallotte River watershed comprises one of 20 watersheds in the Lumber River basin that has been identified by the NC Wetlands Restoration Program (NCWRP) as an area with the greatest need and opportunity for stream and wetland restoration efforts. This watershed will be given higher priority than nontargeted watersheds for the implementation of NCWRP restoration projects. Refer to page 147 in Section C for more information.

### **10.5.3 Lockwoods Folly River [AU# 15-25-1-(11) & 15-25-(16)a & b]**

#### *Current Status and 2003 Recommendations*

Lockwoods Folly River from north of Varnum to the mouth is Impaired for the shellfish harvesting category. The data from ambient monitoring sites, I9440000 and I9450000, showed the fecal coliform values exceeded the geometric mean of 14/100 ml in more than 10 percent of the samples for Class SA waters. See page 66 for more information. DWQ will continue to monitor these stations.

#### *Current Water Quality Initiatives*

The NC Coastal Land Trust received a \$652,000 grant from the CWMTF to acquire 263 acres along Lockwoods Folly River and Sandy Branch. See page 152 for project description.

Lockwoods Folly River watershed comprises one of 20 watersheds in the Lumber River basin that has been identified by the NC Wetlands Restoration Program (NCWRP) as an area with the greatest need and opportunity for stream and wetland restoration efforts. This watershed will be given higher priority than nontargeted watersheds for the implementation of NCWRP restoration projects. Refer to page 147 for more information.

The Army Corps of Engineers has a \$1,440,000 aquatic habitat restoration project on the Lower Lockwoods Folly River (see page 144 for details on the project).

### **10.5.4 Doe Creek [AU# 15-25-1-13]**

#### *Current Status and 2003 Recommendations*

A private developer was assessed a civil penalty for land clearing activities where earth and fill were deliberately placed into wetlands. These activities caused extreme turbid water in an unnamed tributary to Doe Creek. DWQ has required the developer to implement a restoration plan.

### **10.5.5 Mill Creek [AU# 15-25-1-18-(2)]**

#### *Current Status and 2003 Recommendations*

A private owner was assessed a civil penalty for excavating 19,000 linear feet of ditches in wetlands. An unnamed tributary of Mill Creek was impacted by this activity. DWQ has required the owner to implement a restoration plan.

### **10.5.6 Jinny's Branch and Saucepan Creek**

#### *Current Status and Water Quality Initiatives*

Jinny's Branch and Saucepan Creek are currently Impaired for the shellfish harvesting category. The Jinny's Branch/Saucepan Creek watershed comprises one of 20 watersheds in the Lumber River basin that has been identified by the NC Wetlands Restoration Program (NCWRP) as an area with the greatest need and opportunity for stream and wetland restoration efforts. This watershed will be given higher priority than nontargeted watersheds for the implementation of NCWRP restoration projects. Refer to page 147 in Section C for more information.

### **10.5.7 Davis Creek**

#### *Current Water Quality Initiatives*

The Town of Long Beach received a \$456,000 grant from the CWMTF to acquire 30 acres along Davis Creek. See page 152 for project description.

### **10.5.8 Bird Island**

#### *Current Water Quality Initiatives*

NC Division of Coastal Management received a \$2,750,000 grant from the CWMTF to purchase Bird Island. See page 152 for project description.

### **10.5.9 Montgomery Slough [AU# 15-25v]**

#### *Current Status*

Montgomery Slough is currently Supporting for the aquatic life category. However, it is currently Impaired for the shellfish harvesting category.

#### *Current Water Quality Initiative*

The Town of Oak Island received a total of \$2,200,155 from the State Revolving Grants Program for new collections lines and treatment modifications. See page 145 for more information.

## **10.6 Additional Water Quality Issues within Subbasin 03-07-59**

This section discusses issues that may threaten water quality in the subbasin that are not specific to particular streams, lakes or reservoirs. The issues discussed may be related to waters near certain land use activities or within proximity to different pollution sources.

### **10.6.1 Water Quality Threats to Streams in Urbanizing Watersheds**

Streams in this subbasin are already impacted from urban stormwater runoff in shellfish harvesting waters and continue to be threatened development pressure. In order to prevent aquatic habitat degradation and impaired biological communities, protection measures must be put in place immediately. Refer to page 73 for a description of urban stream water quality problems and recommendations for reducing impacts and restoring water quality.

### **10.6.2 Impacts of Post-Hurricane De-Snagging on Instream Habitats**

Many streams in the subbasin have noted impacts from the recent hurricanes. The biological community in the streams can recover rapidly if instream habitat is maintained. De-s snagging operations should carefully remove debris from stream channels to restore natural flow and leave enough instream habitats so the biological community can recover. Refer to page 68 for more information on this issue.

### **10.6.3 Golf Courses**

The number of golf courses in Brunswick County has grown vastly through the last five years making many of the small towns' centers of golf activity. Utilizing best management practices during and after construction of the courses can greatly reduce nonpoint source pollution to adjacent streams. It is critical to implement and maintain these management practices throughout the life of the golf course. See page 78 for more information.

## **Section C**

### **Current and Future Water Quality Initiatives**



## Section C - Chapter 1

### Current Water Quality Initiatives

#### 1.1 Workshop Summaries

In December 2002, there were two workshops held by DWQ in the Lumber River basin in the towns of Southern Pines and Bolivia. There were 33 people in attendance representing a variety of interests. Figure C-1 gives an estimation of groups/interests represented based on information recorded on attendance sheets.

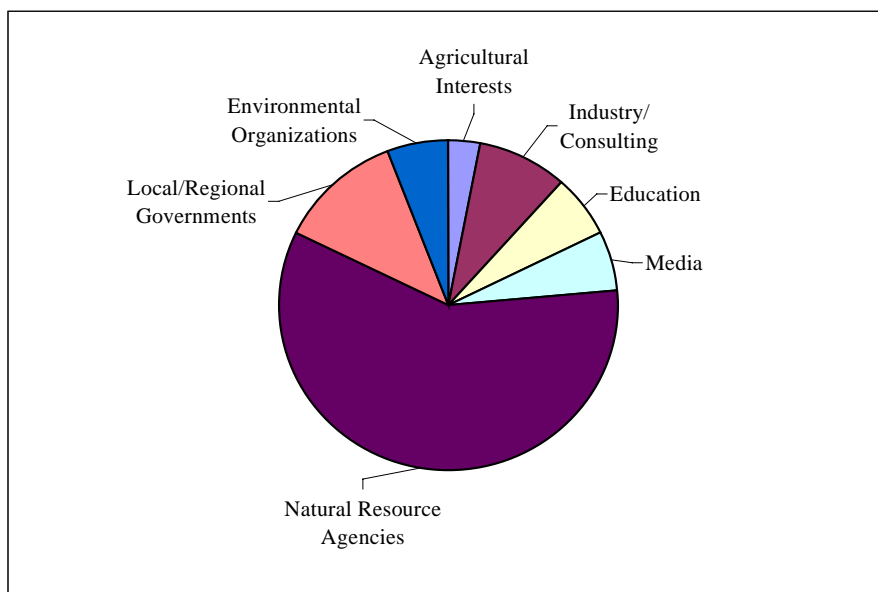


Figure C-1 Total Attendance by Various Interests at DWQ Water Quality Workshops in the Lumber River Basin (2002)

DWQ staff gave presentations about general water quality in the Lumber River basin, basinwide planning and the Wetlands Restoration Program. Participants at each workshop also gave brief presentations about local water quality initiatives. Workshop attendees were asked to discuss the following questions in small groups:

1. What are the main threats to water quality in the Lumber River basin?
2. Where are the problem areas or waters?
3. What recommendations do you have for addressing these problems/waters?
4. What local agencies or organizations should be involved in addressing the problems?

A detailed outline of each small group's discussion of these questions is available upon request. Good discussion was generated at each workshop, and all of the information was considered and, in some cases, incorporated into this draft plan. The most frequently cited threats to water quality identified by workshop participants are discussed below.

## **Important Issues Basinwide**

The most important issues identified by workshop participants were related to development and nonpoint sources of pollution. Increasing urbanization was a concern identified throughout the basin in Brunswick, Moore and Robeson counties. Losses of forestland and wetlands, increases in nutrient loading from many sources, and stormwater runoff were identified as threats to water quality at the workshops. Issues related to enforcement of existing rules and monitoring, lack of BMP maintenance, mercury contamination and better drought planning were also of concern. Refer to Appendix V for summary tables from the workshops.

## **1.2 Federal Initiatives**

### **1.2.1 Clean Water Act – Section 319 Program**

Section 319 of the Clean Water Act provides grant money for nonpoint source demonstration projects. Approximately \$3.46 million is available annually for demonstration and education projects across the state. Project proposals are reviewed and selected by the North Carolina Nonpoint Source Workgroup, made up of state and federal agencies involved in regulation or research associated with nonpoint source pollution. Information on the North Carolina Section 319 Grant Program, including application deadlines and requests for proposals, is available online at <http://h2o.enr.state.nc.us/nps/bigpic.htm>.

A total of \$227,667 has been funded for two projects in the Lumber River basin that have been funded (federal Section 319 money must be matched with nonfederal dollars) through the Section 319 base program between 1999 and 2003.

Many projects sponsored through Section 319 funding have basinwide applications. Many are demonstration projects and educational programs that allow for the dissemination of information to the public. Such programs include Friends of Lake Waccamaw State Park, which has been responsible for hosting education workshops with audio-visuals and on-site demonstrations of nonpoint source pollution solutions. They also produce and distribute a bimonthly newsletter to all landowners in Lake Waccamaw area.

Descriptions of the projects listed below and other Section 319 program information are available at <http://h2o.enr.state.nc.us/nps/319.htm>.

### **1.2.2 Lower Lockwoods Folly River (Subbasin 03-07-59)**

The US Army Corps of Engineers has a \$1,440,000 aquatic habitat restoration project on the Lower Lockwoods Folly River. This project seeks to improve the water quality and resource deterioration by modifying (restoring) the tidal circulation through the Galloway Flats and the Eastern Channel. Also, the placement of oyster culch will be conducted, where needed, to establish oyster habitat in both Galloway Flats and areas adjacent to the Eastern Channel. The dredging (construction) phase is expected to be completed in April 2004, in conjunction with pre- and post-construction monitoring and maintenance (page 144).



Table C-1 Projects Funded Through Clean Water Act Section 319

FY	Project Name	Agency	Project Area	Description	Total Amount Funded
1999	Sandhills Longleaf Pine Ecosystem/ Waste Management Project	Environmental Impact (RC&D), Inc.	Moore, Montgomery and Richmond counties	Waste Management (determine the impact of poultry waste application on longleaf pine ecosystem)	\$61,667
2001	Lake Waccamaw Nonpoint Source Management and Assessment Project	Town of Lake Waccamaw	Lake Waccamaw	Management of stormwater from agricultural and urban sources, education	\$166,000

### 1.3 State Initiatives

#### 1.3.1 NC Division of Water Quality and NC Division of Coastal Management Collaboration

North Carolina's Division of Coastal Management (DCM) and the Division of Water Quality (DWQ) share similar goals regarding water quality, and each program recognizes the value of enhanced coordination in accomplishing program missions. In an effort to enhance coordination, the two programs have agreed to work towards many improved collaborative efforts.

Collaboration is intended to increase collaboration through periodic updates, increased review of each other's work products, and joint efforts to provide guidance and technical support between local land use planning programs and basinwide water quality planning.

Some of agreements include the following:

- DCM will provide written annual updates to DWQ on all types of permit activities occurring in the coastal region when the CAMA Permitted Activities Database is operational. Until that time, DCM will provide file access to any DWQ staff to compile the data themselves. This information will inform DWQ of potential impending cumulative effects of permits issued through CAMA.
- DWQ will periodically contact DCM district offices to relay information and gain feedback about the development or implementation of basinwide water quality plans.
- DWQ will discuss the draft basinwide water quality plan with DCM during the public review phase before soliciting the EMC's endorsement.
- DWQ will provide water quality use support methodology updates to DCM staff.
- DCM and DWQ to discuss the information provided to local land use planners (i.e., data packet, water quality designation information, etc.) on an annual basis.
- DCM to update DWQ periodically on local land use plan certifications.
- DCM to update DWQ on incremental reviews of local land use plan implementation pending recent regulation amendments.
- DCM and the CRC should encourage local governments to participate in the Basinwide Planning Program throughout its planning cycle. DCM will share local governments' contact information with DWQ and distribute DWQ programmatic information. DCM staff will also attend basinwide planning workshops and public meetings to the extent they can.

- DCM will provide a list to DWQ of each local government updating its land use plan at least annually. DWQ will provide each local government updating its plan a summary of the applicable water quality and basinwide plan information contained within that local government's jurisdiction. DWQ will provide the information based on the DWQ basinwide planning scale.
- DWQ will incorporate or at least acknowledge applicable local policies contained in certified local land use plans in the development of the respective basinwide plans. In Section C of the basinwide plans, DWQ will identify those local governments that have developed or implemented programs directed toward water quality restoration or protection.
- DWQ will review all draft local land use plans, provide comments to DCM within 30 days identifying potential problem areas, make suggestions for improvements, and identify violations or potential violations of water quality regulations.
- DCM will update DWQ periodically on the status of permitting analysis/cumulative and secondary impacts assessment. DCM and DWQ will work cooperatively to determine the Permitted Activities database query needs. Once the permit tracking system is operational, DCM will provide access for DWQ to conduct queries.
- DCM and DWQ will discuss the information provided in the *Reviewer's Guide for the Consideration of Cumulative and Secondary Impacts of Proposed Development in NEPA/SEPA Documents* specifically related to coastal water quality.
- DCM and DWQ to discuss DCM's guidelines for assessing and mitigating cumulative and secondary impacts during the CAMA permitting process.

For more information, contact the DWQ Planning Branch at (919) 733-5083.

### **1.3.2 NC Agriculture Cost Share Program**

The North Carolina Agriculture Cost Share Program was established in 1984 to help reduce the sources of agricultural nonpoint source pollution to the state's waters. The program helps owners and renters of established agricultural operations improve their on-farm management by using Best Management Practices (BMPs). These BMPs include vegetative, structural or management systems that can improve the efficiency of farming operations while reducing the potential for surface and groundwater pollution. The Agriculture Cost Share Program is a voluntary program that reimburses farmers up to 75 percent of the cost of installing an approved BMP. The program is implemented by the Division of Soil and Water Conservation (DSWC). The cost share funds are paid to the farmer once the planned control measures and technical specifications are completed. The annual statewide budget for BMP cost sharing is approximately 6.9 million.

From 1998 to 2002, \$3,005,169 was provided for projects in counties wholly or partially in the Lumber River basin. The projects affected over 52,633 acres and saved almost 269,151 tons of soil from erosion. Also, 2,614,440 pounds of nitrogen and 342,223 pounds of phosphorus were saved (NCDENR-DSWC, 2003, ACSP Report: BMP Summary).

Soil and Water Conservation District contacts for the Lumber River basin are included in Appendix VI or visit the website at <http://www.enr.state.nc.us/DSWC/files/acs.htm> for more information.

### 1.3.3 North Carolina Wetlands Restoration Program

The North Carolina Wetlands Restoration Program (NCWRP) is a nonregulatory program responsible for implementing wetland and stream restoration projects throughout the state. The focus of the program is to improve watershed functions in the 17 river basins across the state by restoring wetlands, streams and riparian buffers within selected local watersheds. These vital watershed functions include water quality protection, floodwater retention, fisheries and wildlife habitat, and recreational opportunities. The NCWRP is not a grant program. Instead, the program funds local restoration projects directly through the Wetlands Restoration Fund.

Restoration sites are targeted through the development and use of Watershed Restoration Plans (formerly called "Basinwide Wetland and Riparian Restoration Plans"). The restoration plans are developed, in part, using information compiled in DWQ's Basinwide Water Quality Plans and Basinwide Assessment Reports. The NCWRP Plans evaluate resource data and existing water quality initiatives within local watersheds in order to select "Targeted Local Watersheds". Targeted Local Watersheds are areas with the greatest need and opportunity for stream and wetlands restoration efforts, and where NCWRP resources can be most efficiently focused for maximum restoration benefit. The NCWRP Watershed Restoration Plans are updated every five years, generally on the same timeline as DWQ's Basinwide Water Quality Plans.

The selection of Targeted Local Watersheds (at the scale of NRCS 14-digit Hydrologic Units, or HUs) does not necessarily restrict the location of NCWRP restoration project sites. However, these targeted HUs are given higher priority than nontargeted HUs in considering the selection of NCWRP candidate restoration project sites. Targeted Local Watersheds are simply local watersheds where stream, wetland and riparian buffer restoration projects will make the most sense in the context of overall watershed and wetlands protection.

The NCWRP is also working to develop comprehensive Local Watershed Plans within certain Targeted Local Watersheds identified in the Watershed Restoration Plans. These locally-based plans develop comprehensive watershed assessments to identify causes and sources of nonpoint source impairment. They also identify and prioritize wetland areas, stream reaches, riparian buffer areas and best management practices that will provide significant water quality improvement and other environmental benefits to local watersheds. The NCWRP will coordinate with local community groups, local governments and others to develop and implement these plans.

Selection of a watershed as a Targeted Local Watershed does not mean that a Local Watershed Plan will be initiated in that area. Local Watershed Plans are developed in areas that have extensive future mitigation needs, while Targeted Local Watersheds are selected as part of the NCWRP planning process for the Basinwide Watershed Restoration Plans.

The NCWRP can perform restoration projects cooperatively with other state or federal programs or environmental groups. For example, the NCWRP's efforts can complement projects funded through the Section 319 Program. Integrating wetlands or riparian area restoration components with Section 319 funded or proposed projects will often improve the overall water quality benefits of the project. The NCWRP actively seeks landowners within the Lumber River basin that have restorable wetland, riparian and stream sites.

For more information about the NCWRP and its Watershed Restoration Plans, please contact George Norris at (919) 733-5312 or visit the DWQ website at <http://h2o.enr.state.nc.us/> (click on Wetlands Restoration Program).

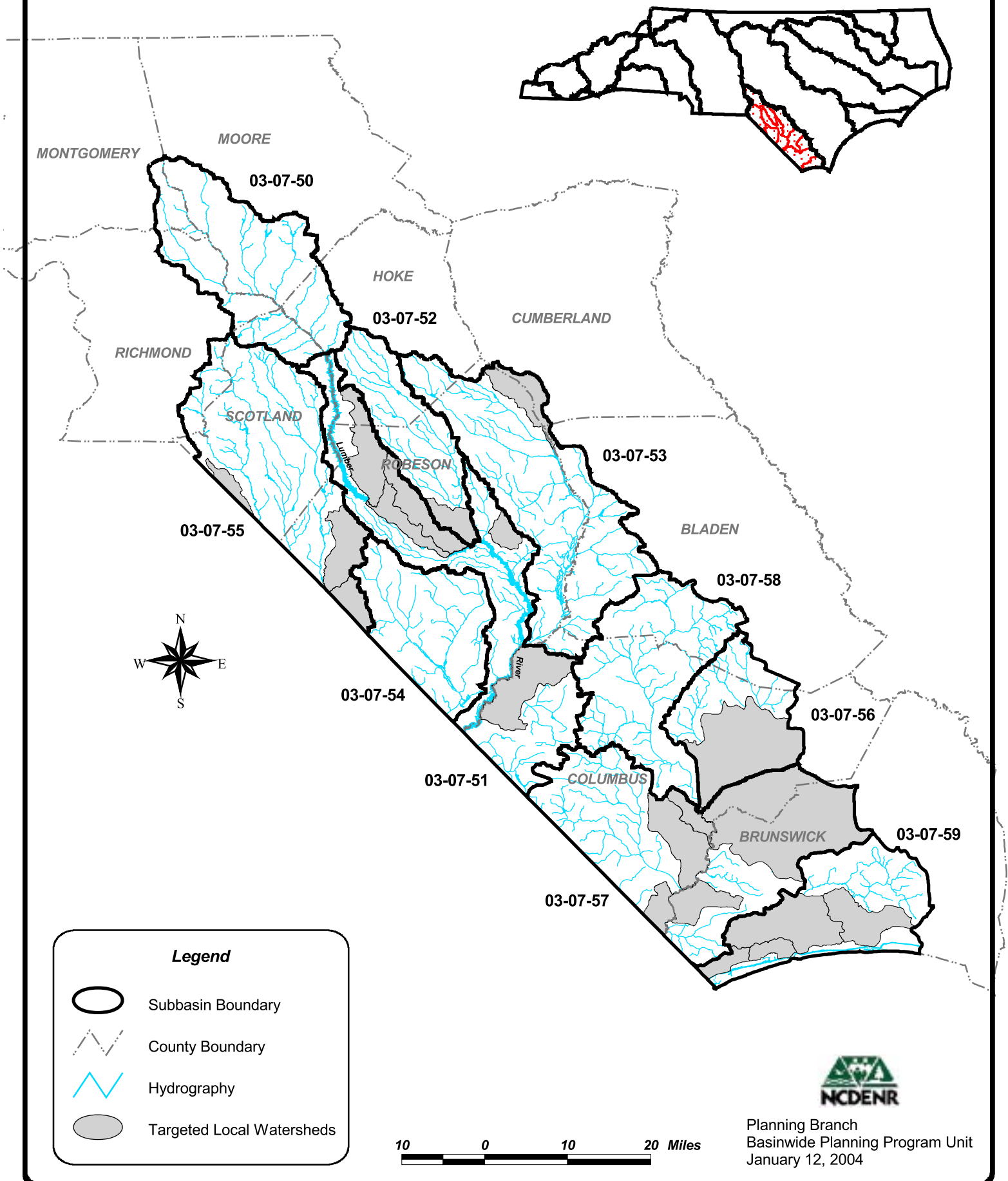
Table C-2 below lists the NCWRP's Targeted Local Watersheds [stream names and 14-digit HU codes] in the Lumber River basin. This table also indicates the pertinent factors that led to the selection of each Targeted Local Watershed. The Targeted Local Watersheds are selected on the basis of available data indicating the need and opportunity for local stream and wetlands restoration projects. Factors such as water quality problems, degraded aquatic habitat, cleared riparian buffers, significant natural areas or species, and increasing development pressures in the watershed are weighted heavily in determining these priority watersheds. Also, the presence of existing or planned water quality or habitat restoration projects in the same local watershed can be a significant factor in the choice of these watersheds. In some cases, NCWRP has used the water quality information alone (e.g., use impairment, potential increases in nonpoint source pollution) to support the selection of a specific Targeted Local Watershed. Targeted local watersheds are presented in Figure C-2.

Table C-2 Wetlands Restoration Program Targeted Local Watersheds (2003)

Subbasin	Local Watershed Name and HU code	Impaired Stream(s)	Downward Trend in W. Quality	Public Water Supply	SA Waters	ORW or HQW	Aquatic NHP Elements	Existing, Planned Projects	Municipality(ies); Phase I or II	Local Resource Professional Recommendation
03-07-51	03040203030010 Mill Branch									Yes
03-07-51	03040203040010 Gum Swamp									Yes
03-07-51	03040203050010 Bear Swamp									Yes
03-07-51	03040203080020 Ivey Branch			Yes		Yes		Yes DOT		
03-07-51	03040203190010 Cow Branch							Yes NCWRP		
03-07-52	03040203160030 Lower Raft Swamp									Yes
03-07-53	03040203110010 Cold Camp Creek									Yes
03-07-55	03040204010060 Panther Swamp/ Bear Creek									Yes
03-07-55	03040204048010 Wilkinson Creek									Yes
03-07-55	0304020403710 Mitchell Swamp									Yes
03-07-56	03040206020040 Upper Waccamaw River					Yes	Yes			Yes
03-07-57	03040206030010 Juniper Swamp						Yes			Yes

03-07-57	03040206010070 Upper Waccamaw River						Yes			Yes
03-07-57	03040206050010 Middle Waccamaw River						Yes			Yes
03-07-57	03040206060010 Gore Creek						Yes			Yes
03-07-57	03040206090010 Big Creek						Yes			Yes
03-07-59	03040207020030 Lockwoods Folly	Yes			Yes	Yes				
03-07-59	03040207020060 Shallotte River	Yes			Yes	Yes				
03-07-59	03040207020110 Calabash Creek	Yes			Yes	Yes				
03-07-59	03040207020090 Jinny's Branch/ Saucepan Creek				Yes	Yes				

**Figure C-2 NCWRP Targeted Local Watersheds  
in the Lumber River Basin**



### 1.3.4 Clean Water Management Trust Fund

North Carolina's Clean Water Management Trust Fund (CWMTF) was established by the General Assembly in 1996 (Article 13A; Chapter 113 of the North Carolina General Statutes). At the end of each fiscal year, 6.5 percent of the unreserved credit balance in North Carolina's General Fund (or a minimum of \$30 million) goes into the CWMTF. Revenues from the CWMTF are then allocated in the form of grants to local governments, state agencies and conservation nonprofit organizations to help finance projects that specifically address water pollution problems. The 18-member, independent, CWMTF Board of Trustees has full responsibility over the allocation of moneys from the fund.

The CWMTF funds projects that: 1) enhance or restore degraded waters; 2) protect unpolluted waters; and/or 3) contribute toward a network of riparian buffers and greenways for environmental, educational and recreational benefits. In the Lumber River basin, 30 projects have been funded for over 20 million dollars (\$20,232,900). Table C-3 presents total basin funding amounts by year and category listed by individual grants. For more information on the CWMTF or these grants, call (252) 830-3222 or visit the website at [www.cwmtf.net](http://www.cwmtf.net).

Table C-3 Projects in the Lumber River Basin Funded by the Clean Water Management Trust Fund (as of 12/02)

FY	Application Name	Proposed Project Description	Amount Funded	Subbasin
2002A-027	Sandhills Area Land Trust – Acq / Drowning Cr. II: Camp Mu-Sha-Ni	Acquire permanent conservation easement on 84.3 acres along Drowning Creek. CWMTF would fund 50% of the cost of the conservation easement, attorney and deed registration fees.	\$44,000	03-07-50
1999B-015	Sandhills Area Land Trust – Drowning Creek Conservation Easement	Acquire through permanent conservation easements 68 acres along Drowning Creek and tributaries. CWMTF funds to acquire easement on 21 acres of riparian land and landowners to donate an additional 47 acres.	\$31,250	03-07-50
2001B-047	Sandhills Area Land Trust – Acquisition / Drowning & Naked Creeks	Provide funds to cover transactional and stewardship costs. Project to protect 105 acres through purchase of permanent conservation easements (5 acres) and donated easements (100 acres) on Drowning and Naked Creeks.	\$40,000	03-07-50
1998A-203	Sandhills Area Land Trust – Drowning Creek Conservation Easements	Provides planning funds to pursue permanent conservation easements along Drowning Creek and tributaries. Includes \$10,000 for options.	\$96,000	03-07-50
2001A-027	Sandhills Area Land Trust – Drowning Creek Land Acquisition	Acquire through fee simple purchase and permanent conservation easements 414 acres along Drowning Creek and Deep Creek. Acquire one tract in fee simple and three tracts by conservation easements.	\$389,000	03-07-50
2001B-013	Lumberton – Acquisition and Greenway / Lumber River	Acquire through fee simple purchase or permanent conservation easements 24 acres and fund greenway planning and design along the Lumber River.	\$69,000	03-07-51
1999B-509	Lumberton – I/I	Replace existing pumps with submersible pumps and raise walls at Station #1. Clean and inspect 10,000 liner feet of sewer main. Install backup power generation at 10 pump stations.	\$692,000	03-07-51



1998B-511	Lumberton – Combined Sewer / Stormwater Separation	Separate combined sewer and stormwater lines and repair leaking sewer lines. Propose to separate 4,650 LF of combined sewer and stormwater lines.	\$1,000,000	03-07-51
2000A-901	Cape Fear RC&D – Columbus County / No-Till Drill	Provide funds for a no-till drill to be used primarily in the Porter Swamp watershed.	\$20,150	03-07-51
1997B-002	NC Div Parks & Rec – Acq / Princess Ann Swamp & Lumber River	Acquire through fee simple purchase 1,831 acres in the Princess Anne Swamp Area along the Lumber River.	\$550,000	03-07-51
1997A-108	NC Div Parks & Rec – Acq / Big McQueen Tract / Lumber River	Acquire through fee simple purchase 1,690 acres in two tracts along the Lumber River.	\$400,000	03-07-51
1998A-602	Pembroke – Wastewater Collection System to Deep Branch School	Install pumping station and sewer line (17,200 LF) to reroute wastewater from Deep Branch School's failing sand filter system to the Town of Pembroke's WWTP. Decommission school system. WWTP repairs (valve for chlorine and sludge pump).	\$380,000	03-07-51
1997B-611	Wagram – Wastewater Collection System	Construct sewer collection system (83,000 GPD) to eliminate over 370 failing septic systems. Waste will be pumped to the Laurinburg-Maxton Airport Commission's WWTP.	\$400,000	03-07-51
2001A-506	Red Springs – Sewer Rehabilitation	Fund the first major phase of the town's I&I and sewer rehab program. Construct two new pump stations and a new force main (2000 LF), abandon a leaking gravity outfall, and rehabilitate a section of another leaking gravity outfall (5,000 LF).	\$351,000	03-07-52
1999B-510	Parkton – Sewer Rehabilitation	Rehabilitate existing wastewater collection system (11,582 LF and 46 manholes) to reduce groundwater and rainwater inflow and infiltration into the sanitary sewer system and to eliminate toxicity problems at WWTP.	\$670,000	03-07-53
1999B-515	St. Pauls – Backup Generation	Purchase and install two 3-phase generators to support WWTP and pump stations and to prevent sewer overflows and bypasses during power outages. Purpose to prevent frequent sewer spills to Big Marsh Swamp.	\$95,000	03-07-53
2001A-509	St. Pauls – WWTP Improvements	Design and construct improvements at the town's WWTP, to eliminate discharge of untreated wastewater. Includes constructing a second clarifier and an equalization basin. Monitor results.	\$296,000	03-07-53
2001B-501	Bladenboro – Wastewater Land Application & Acquisition / Bryant Swamp	Provide up to 80% of the cost of constructing a wastewater land application system to treat up to 0.25 MGD of its 0.5 MGD permitted discharge into Bryant Swamp. Funds for acquisition of 135-acre spray site and irrigation equipment.	\$1,863,000	03-07-53
1997A-118	Fairmont – WWTP Construction & Consolidation / Pittmans Mill Branch	Construct new, consolidated wastewater treatment plant that will discharge to Lumber River, rather than a zero flow stream. Eliminate school discharge. CWMTF pays approximately 15% of total costs.	\$1,000,000	03-07-54
2000B-012	NC Wildlife Resources Commission – Breeden Tract / Sandhills Acq	Acquire through fee simple purchase 100 acres along Upper Beaverdam Creek. CWMTF funds to purchase a portion of the riparian acreage.	\$46,000	03-07-55
1997B-506	Gibson – Sewer Rehabilitation	Rehabilitate Gibson's existing wastewater collection system (5,000 LF and manholes) in order to reduce groundwater and rainwater inflow and infiltration into the sanitary sewer system.	\$286,500	03-07-55

2000B-705	Lake Waccamaw – Stormwater Management System / Lake Waccamaw	Construct comprehensive stormwater system for runoff flowing into Lake Waccamaw. Includes 3 wet retention ponds, 3 pump stations, and new and upgraded storm sewers. Town to adopt ordinance to prohibit stormwater discharges into the lake. Monitor results.	\$4,500,000	03-07-56
2001B-040	NC Wildlife Resources Commission – Acquisition / Waccamaw River and Juniper Creek	Acquire through fee simple purchase 2,530 acres along the Waccamaw River and Juniper Creek.	\$900,000	03-07-57
1997A-117	Tabor City – WWTP Improvements	Add a tertiary filtration process (deep sand beds) to the wastewater management system, prior to chlorination. Should substantially reduce suspended solids and oxygen demanding wastes. Discharge monitoring will be reported to DWQ-WiRO.	\$570,000	03-07-57
1998A-508	Chadbourn – Sewer Rehab & Collection Sys / Soules & White Marsh Swamp	Rehabilitate Chadbourn's existing wastewater collection system in order to reduce groundwater and rainwater inflow and infiltration into the sanitary sewer system.	\$1,312,000	03-07-58
2000B-007	Nature Conservancy – Acq – Waccamaw River / Railroad Tract	Acquire through fee simple purchase 61 acres along White Marsh swamp, a tributary of the Waccamaw River.	\$84,000	03-07-58
2001B-022	Nature Conservancy – Acquisition / White Marsh and Waccamaw River	Acquire 456 acres through fee simple purchase along White Marsh and the Waccamaw River.	\$290,000	03-07-58
2002A-020	NC Coastal Land Trust	Acquire a permanent conservation easement on 263 acres along Lockwoods Folly River and Sandy Branch. CWMTF would fund acquisition of easement on 143 riparian acres.	\$652,000	03-07-59
1998A-001	Long Beach – Acq / Septic Tank Mgmt / Drainage Impv – Davis Creek	Acquire 30-acre tract (The Point) and easements on Davis Creek. Restore free flow drainage by removing obstacles at two bridges. Small program to assess septic tanks.	\$456,000	03-07-59
2001A-019	NC Div Coastal Management, NCCLT & NCCF – Bird Island Acq	Acquire through fee simple purchase Bird Island, totaling 1200 acres.	\$2,750,000	03-07-59

### 1.3.5 NC Construction Grants and Loans Program

The NC Construction Grants and Loans Section provides grants and loans to local government agencies for the construction, upgrade and expansion of wastewater collection and treatment systems. As a financial resource, the section administers two major programs that assist local governments, the federally funded Clean Water State Revolving Fund (SRF) Program and the NC Clean Water Revolving Loan and Grant Program. These programs can provide both low interest loan and grant funds for wastewater treatment projects. In the Lumber River basin, seven applicants have been offered a total of \$13,032,255 in SRG projects, and two applicants have been offered a total of \$2,154,350 in SRL projects (Table C-4).

As a technical resource, the Construction Grants and Loans Section, in conjunction with the Environmental Protection Agency, has initiated the Municipal Compliance Initiatives Program. It is a free technical assistance program to identify wastewater treatment facilities that are declining but not yet out of compliance. A team of engineers, operations experts and managers from the section work with local officials to analyze the facility's design and operation.

For more information, visit the website at <http://www.nccgl.net/>. You may also call (919) 715-6212 or email [Bobby.Blowe@ncmail.net](mailto:Bobby.Blowe@ncmail.net).

Table C-4 Projects in the Lumber River Basin Funded by the NC Construction Grants and Loans Section

<b>Funded Grant (Clean Water Bond or SRG) Projects</b>		
<b>Applicant</b>	<b>Grant Offered</b>	<b>Project</b>
Calabash/SBWSA	\$3,000,000	New Collection & Transmission System
Gibson	\$646,100	WWTP Upgrade & Expansion
Lumberton	\$3,000,000	I/I and CSO Correction
Oak Island	\$563,000	Treatment Modifications
Oak Island	\$1,637,155	New Collection Lines
St. Pauls	\$1,186,000	New Collection Lines
Tabor City	\$3,000,000	New Collection Lines
<b>Funded Grant State Revolving Loan (SRL) Projects</b>		
<b>Applicant</b>	<b>Loan Offered</b>	<b>Project</b>
Lake Waccamaw	\$588,000	New Collection Lines
Lumberton	\$1,566,350	Divert Flow to SW Interceptor

### 1.3.6 North Carolina Stream Watch

The realization that local residents are best suited to keep an eye on their nearby waterways is what prompted North Carolina to begin project Stream Watch. With Stream Watch, citizens groups "adopt" a waterway, or a portion of one, and act on its behalf. Stream Watchers become the adoptive parents of a stream and, as such, become its primary caretakers.

With the help of the Department of Environment and Natural Resources' Division of Water Resources, Stream Watchers become informed stewards, learning how to react to the changing stream conditions. Local efforts combined with state support allow North Carolina's 37,000 miles of waterways to be monitored by those with the best view--local residents. In the Lumber River basin, there are four different groups monitoring different stream segments. For more information on Stream Watch, call (919) 715-5433 or visit the website at [http://www.ncwater.org/Education\\_and\\_Technical\\_Assistance/Stream\\_Watch/](http://www.ncwater.org/Education_and_Technical_Assistance/Stream_Watch/).

### 1.3.7 South Carolina Department of Health and Environmental Control

In 1991, the South Carolina Department of Health and Environmental Control (SCDHEC) Bureau implemented the Watershed Water Quality Management Strategy in order to more efficiently protect and improve the quality of South Carolina's surface water resources. This

management strategy recognizes the interdependence of water quality and all the activities that occur in the associated drainage basin. Under the watershed management approach, monitoring, assessment, problem identification and prioritization, water quality modeling, planning, permitting and other SCDHEC initiatives are coordinated by basin. A watershed water quality assessment document is produced for each basin on a five-year rotating schedule. The first Watershed Water Quality Assessment for the Pee Dee River basin was published in May 2000 and will be updated on a five-year rotational basis.

To obtain a copy of the Watershed Water Quality Assessment or for further information about water quality in the Pee Dee River basin in South Carolina, contact Mark A. Giffin at (803) 898-4022 or by email [giffinma@dhec.sc.gov](mailto:giffinma@dhec.sc.gov) or visit the website at <http://www.scdhec.net/water>.

### **1.3.8 North Carolina Coastal Nonpoint Source Program**

Section 6217 of the Federal 1990 Coastal Zone Act Reauthorization Amendments (CZARA) requires every state participating in the Coastal Zone Management Act Program to develop a Coastal Nonpoint Source Program (CNPS). The purpose of this requirement, as stated in the Act, is to "strengthen the links between Federal and State coastal zone management and water quality management programs and to enhance State and local efforts to manage land use activities that degrade coastal waters and coastal habitats." To accomplish these goals, the federal agencies established 56 Management Measures that are to be used by each state to address the following nonpoint source pollution categories (first five items) and that provide tools to address the various sources of nonpoint pollution (last item):

- *Agricultural Sources*
- *Forestry*
- *Urban Areas* (urban runoff; construction activities; existing development; on-site disposal systems; pollution prevention; and roads, highways, and bridges)
- *Marinas and Recreational Boating* (siting and design; and marina and boat operation/maintenance)
- *Hydrologic Modification* (channelization and channel modification; dams; and streambank and shoreline erosion)
- *Wetlands, Riparian Areas, and Vegetated Treatment Systems*

At the federal level, the program is called the Coastal Nonpoint Pollution Control Program and is administered jointly by the National Oceanic and Atmospheric Administration (NOAA) and the Environmental Protection Agency (EPA). Within North Carolina, the state program is administered by the Division of Water Quality (DWQ) and the Division of Coastal Management (DCM) and is referred to as the Coastal Nonpoint Source Program. The state program currently has one full time permanent staff person and one temporary employee, both located in the Nonpoint Source Planning Unit of DWQ.

The 56 Management Measures are defined in Section 6217(g)(5) of CZARA as: "economically achievable measures for the control of the addition of pollutants from existing and new categories and classes of nonpoint sources of pollution, which reflect the greatest degree of pollutant reduction achievable through application of the best available nonpoint pollution control practices technologies, processes, siting criteria, operating methods or other alternatives."

Detailed descriptions of the management measures, where they are intended to be applied, their effectiveness, and their costs can be found in EPA's "Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters" at the following website: <http://www.epa.gov/owow/nps/MMGI/>.

North Carolina received approval from NOAA and EPA for its state program on August 13, 2003. To receive this approval, North Carolina had to identify that we have enforceable policies and mechanisms for the 56 Management Measures and establish our program boundary. We are now required to develop a strategy to ensure all applicable Management Measures to protect and restore water quality are implemented within 15 years.

North Carolina is relying on existing authorities and programs and proposed projects to meet federal requirements but it may become apparent in the future that additional Management Measures and new regulations are needed to address significant sources of nonpoint sources. If a need arises for new or modified regulations they would be proposed under existing agency frameworks.

The core of the state's CNPSP is increased communication and coordination between DWQ and key state agencies that have regulatory responsibilities for controlling nonpoint sources of pollution. This increased dialogue is facilitated in part by the state's CNPSP Coordinator and promotes identification of gaps, duplications, inadequacies and/or inefficiencies of existing programs and policies. Responsibilities of the state program coordinator also include developing the 15-year Strategy Plan, serving as a liaison between DWQ and DCM, and participating in the development of nonpoint source outreach and educational activities. For more information, contact the NC Coastal Nonpoint Source Program Coordinator at (919) 733-5083, ext. 567 or [gloria.putnam@ncmail.net](mailto:gloria.putnam@ncmail.net).

### **1.3.9 North Carolina Flood Plain Mapping Program**

The State of North Carolina, through the Federal Emergency Management Agency's (FEMA's) Cooperating Technical Partnership initiative, has been designated as the first Cooperating Technical State (CTS). As a CTS, the state will assume primary ownership and responsibility of the National Flood Insurance Program (NFIP) Flood Insurance Rate Maps (FIRMs) for North Carolina CTS Flood Mapping Program will include conducting flood hazard analyses and producing updated, digital FIRMs. For more specific information on the Lumber River basin efforts, visit [http://www.ncfloodmaps.com/pubdocs/Final\\_Basin\\_Plan\\_Lumber.pdf](http://www.ncfloodmaps.com/pubdocs/Final_Basin_Plan_Lumber.pdf).

## **1.4 Local Initiatives**

### **1.4.1 Friends of Lake Waccamaw State Park**

The Friends of Lake Waccamaw State Park (FLWSP) members and volunteers have been committed to the protection of water quality and the national significance for biological diversity on the park lands and in Lake Waccamaw as well as the Waccamaw River watershed since 1986. Initiatives include funding for projects to improve and support clean water in and around Lake Waccamaw and the Waccamaw River. FLWSP is currently providing ongoing education

programs, newsletters and water quality testing funded by the EPA 319 Nonpoint Source Pollution Program. FLWSP continues to support the Town of Lake Waccamaw in acquiring funds for reducing nonpoint source pollution with a grant from the NC Clean Water Management Trust Fund for a stormwater management project and local regulation of stormwater pollution. Friends of Lake Waccamaw State Park can be contacted at [friendslwsp@weblink.net](mailto:friendslwsp@weblink.net).

## **1.4.2 Winyah Rivers Foundation**

The Waccamaw Watershed Academy, in the Center for Marine and Wetland Studies at Coastal Carolina University (CCU) in South Carolina, has sponsored a variety of research and educational activities in concert with the Waccamaw Riverkeeper®. These projects include scientific work funded by an USEPA Section 319 grant and is conducted in-house by a state-certified environmental quality lab. For further information, visit the website at <http://www.coastal.edu/envsci/> or contact [susan@coastal.edu](mailto:susan@coastal.edu). The Waccamaw Riverkeeper® is licensed by the Waterkeeper Alliance, Inc. and housed within CCU's Center for Marine and Wetland Studies. The Riverkeeper® is supported by the Winyah Rivers Foundation where the mission is to protect, preserve, monitor and revitalize the health of the lands and waters of the Greater Winyah Watershed. The foundation currently has 350 members. More information can be obtained from <http://www.winyahrivers.org> and contacting the Waccamaw Riverkeeper®, Hamp Schuping, at [wrk@coastal.edu](mailto:wrk@coastal.edu).

## **1.5 Regional Initiatives**

### **1.5.1 Conservation Trust for North Carolina**

The Conservation Trust for North Carolina and CWMTF have funded two riparian corridor conservation plans in the Lumber River basin. Plans were prepared for the Drowning Creek watershed (subbasin 03-07-50) and the Waccamaw River (subbasin 03-07-56 and 03-07-57).

### **1.5.2 Lumber River Council of Government**

#### **Surface Water Initiatives of the Lumber River COG**

In 1998, the Lumber River Council of Governments (LRCOG) published a report on the potential regionalization of wastewater discharge points within a large portion of the Lumber River basin. A section on this report contained a recommendation to begin organizing a basinwide planning organization comprised of the region's stakeholders. Since 1998, the LRCOG has taken the initiative in addressing water resource concerns within the southeastern region of North Carolina, particularly within the Lumber River basin. In 2000, the LRCOG established the ***Lumber River Basin Consortium***. The consortium is a multi-stakeholder membership which includes business and industry; environmental groups; federal, state and local agencies such as Cooperative Extension and Soil and Water Conservation Service; the agricultural community; and educational/research institutions. The consortium's goal is to provide direction and recommendations for implementation on surface water issues and extend its reach to: 1) provide water quality research; 2) assist in water conservation education; and 3) promote wise stewardship of surface water resources. The consortium hopes to serve as a forum

to provide coordinated management, communication among stakeholders, and assist in resolving water resource issues and concerns within the basin. In December of 2002, the LRCOG completed the **Lumber River Basin Strategic Plan**. This document lists strategies to help the consortium establish its leadership role in the Lumber River basin. Components of the plan will include descriptions of the current status and future needs related to:

1. River Monitoring
2. Education
3. Advocacy
4. Intra-State Agreements
5. Inter-State Agreements with South Carolina
6. Riparian Buffers
7. River-Cleanup/Restoration
8. Public Awareness

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# **Appendix I**

## **NPDES Dischargers and Individual Stormwater Permits in the Lumber River Basin**



***NPDES Dischargers for the Lumber River Basin (as of November 27, 2002)***

Permit	Owner	Facility	County	Region	Type	Class	MGD	Subbasin	Receiving Stream
NC0035904	NC Department of Correction	McCain Hospital WWTP	Hoke	Fayetteville	Industrial Process & Commercial	Minor	0.2	03-07-50	Mountain Creek
NC0037508	Moore County Public Utilities	Moore County WWTP	Moore	Fayetteville	Municipal, Large	Major	6.7	03-07-50	Aberdeen Creek
NC0049778	Town of Southern Pines	Southern Pines WTP	Moore	Fayetteville	Water Plants and Water Conditioning	Minor	not limited	03-07-50	Aberdeen Creek
NC0086398	Newfields, Inc.	Aberdeen Pesticide Dumps Site	Moore	Fayetteville	Groundwater Remediation	Minor	0.072	03-07-50	Aberdeen Creek
NC0004618	Alamac American Knits LLC	Lumberton Plant	Robeson	Fayetteville	Industrial Process & Commercial	Major	2.56	03-07-51	Lumber River
NC0005321	Buckeye Lumberton Inc	Buckeye Lumberton Incorporated	Robeson	Fayetteville	Industrial Process & Commercial	Major	2.5	03-07-51	Lumber River
NC0005363	CP&L - A Progress Energy Company	Weatherspoon Steam Electric Plant	Robeson	Fayetteville	Industrial Process & Commercial	Major	not limited	03-07-51	Lumber River
NC0005762	West Point Stevens, Inc	Wagram Plant	Scotland	Fayetteville	Industrial Process & Commercial	Major	4.5	03-07-51	Lumber River
NC0020729	Town of Fair Bluff	Fair Bluff Town - WWTP	Columbus	Wilmington	Municipal, < 1MGD	Minor	0.23	03-07-51	Lumber River
NC0024571	City of Lumberton	Lumberton WWTP	Robeson	Fayetteville	Municipal, Large	Major	10.0	03-07-51	Lumber River
NC0027103	Town of Pembroke	Town of Pembroke WWTP	Robeson	Fayetteville	Municipal, Large	Major	1.33	03-07-51	Lumber River
NC0034100	Robeson County Schools	Orum High School	Robeson	Fayetteville	100% Domestic < 1MGD	Minor	0.006	03-07-51	Flowers Swamp
NC0048577	Robeson County Water Department	Maxton WTP	Robeson	Fayetteville	Water Plants and Water Conditioning	Minor	not limited	03-07-51	Lumber River
NC0058301	Lumberton Power LLC	Lumberton Power LLC	Robeson	Fayetteville	Industrial Process & Commercial	Minor	not limited	03-07-51	Lumber River
NC0084204	Robeson County Water Department	Kenric Road WTP	Robeson	Fayetteville	Water Plants and Water Conditioning	Minor	not limited	03-07-51	Lumber River
NC0086550	Town of Fairmont	Fairmont Regional WWTP	Robeson	Fayetteville	Municipal, Large	Major	1.75	03-07-51	Lumber River
NC0086738	City of Lumberton	Lowery Street WTP	Robeson	Fayetteville	Water Plants and Water Conditioning	Minor	not limited	03-07-51	Lumber River
NC0086991	Robeson County Water Department	Sanchez Drive WTP	Robeson	Fayetteville	Water Plants and Water Conditioning	Minor	not limited	03-07-51	Little Back Swamp
NC0025577	Town of Red Springs	Red Springs WWTP	Robeson	Fayetteville	Municipal, Large	Major	2.5	03-07-52	Little Raft Swamp
NC0044725	Laurinburg-Maxton Airport Commission	Laurinburg-Maxton Airport WWTP	Scotland	Fayetteville	Municipal, Large	Major	2.0	03-07-52	Lumber River
NC0086045	Hoke County	Antioch WTP	Hoke	Fayetteville	Water Plants and Water Conditioning	Minor	not limited	03-07-52	Raft Swamp
NC0020095	Town of St. Pauls	St. Pauls WWTP	Robeson	Fayetteville	Municipal, < 1MGD	Minor	0.5	03-07-53	Big Marsh Swamp (Marsh Swamp) (Lake McNeill, Odom Pond)
NC0026352	Town of Bladenboro	Town of Bladenboro WWTP	Bladen	Fayetteville	Municipal, < 1MGD	Minor	0.5	03-07-53	Bryant Swamp

***NPDES Dischargers for the Lumber River Basin (as of November 27, 2002)***

Permit	Owner	Facility	County	Region	Type	Class	MGD	Subbasin	Receiving Stream
NC0026921	Town of Parkton	Parkton WWTP	Robeson	Fayetteville	Municipal, < 1MGD	Minor	0.2	03-07-53	Dunns Marsh (Hughes Mill Pond)
NC0085685	Robeson County Water Department	Lumber Bridge WTP	Robeson	Fayetteville	Water Plants and Water Conditioning	Minor	not limited	03-07-53	Big Marsh Swamp (Marsh Swamp) (Lake McNeill, Odom Pond)
NC0086037	Hoke County	Arabia WTP	Hoke	Fayetteville	Water Plants and Water Conditioning	Minor	not limited	03-07-53	Little Marsh Swamp
NC0005479	Laurinburg-Maxton Airport Commission	Laurel Hill/Maxton WWTP	Scotland	Fayetteville	Industrial Process & Commercial	Minor	0.3	03-07-55	Gum Swamp Creek (Lytchs Pond)
NC0005754	Springs Industries	Springfield Plant	Scotland	Fayetteville	Industrial Process & Commercial	Minor	0.03	03-07-55	Gum Swamp Creek (Lytchs Pond)
NC0020656	City of Laurinburg	Leiths Creek WWTP	Scotland	Fayetteville	Municipal, Large	Major	4.0	03-07-55	Shoe Heel Creek (Big Shoe Heel Creek) (Maxton Pond)
NC0021661	City of Laurinburg	Libbey-Owens-Ford WWTP	Scotland	Fayetteville	Municipal, < 1MGD	Minor	0.03	03-07-55	Little Shoe Heel Creek
NC0027120	Town of Maxton	Maxton WWTP	Robeson	Fayetteville	Municipal, < 1MGD	Minor	0.6	03-07-55	Little Shoe Heel Creek
NC0029769	NC Department of Correction	Scotland County Correctional Center	Scotland	Fayetteville	100% Domestic < 1MGD	Minor	0.018	03-07-55	Shoe Heel Creek (Big Shoe Heel Creek) (Maxton Pond)
NC0035777	Scotland County Schools	Scotland Accelerated Academy	Scotland	Fayetteville	100% Domestic < 1MGD	Minor	0.0112	03-07-55	Lower Beaverdam Creek
NC0036773	City of Laurinburg	Laurinburg WTP	Scotland	Fayetteville	Water Plants and Water Conditioning	Minor	not limited	03-07-55	Big Branch
NC0049514	Libbey-Owens-Ford Company	Plant 75	Scotland	Fayetteville	Industrial Process & Commercial	Minor	not limited	03-07-55	Little Shoe Heel Creek
NC0069612	Town of Rowland	Rowland WWTP	Robeson	Fayetteville	Municipal, < 1MGD	Minor	0.387	03-07-55	Shoe Heel Creek (Big Shoe Heel Creek) (Maxton Pond)
NC0086894	Robeson County Water Department	Raemon Well WTP	Robeson	Fayetteville	Water Plants and Water Conditioning	Minor	not limited	03-07-55	First Swamp
NC0006858	Council Tool Company	Council Tool Company	Columbus	Wilmington	Industrial Process & Commercial	Minor	not limited	03-07-56	Lake Waccamaw
NC0021881	Town of Lake Waccamaw	Lake Waccamaw WWTP	Columbus	Wilmington	Municipal, < 1MGD	Minor	0.4	03-07-56	Bogue Swamp
NC0026000	Town of Tabor City	Tabor City WWTP	Columbus	Wilmington	Municipal, Large	Major	1.1	03-07-57	Grissett Swamp
NC0043745	Columbus County Schools	Old Dock Elementary School WWTP	Columbus	Wilmington	100% Domestic < 1MGD	Minor	0.005	03-07-57	Gum Swamp Run
NC0044873	Carolina Blythe Utility Co., Inc.	Carolina Shores WWTP	Brunswick	Wilmington	100% Domestic < 1MGD	Minor	0.53	03-07-57	Persimmon Swamp
NC0045276	Brunswick County Schools	Waccamaw Elementary School	Brunswick	Wilmington	100% Domestic < 1MGD	Minor	0.0057	03-07-57	Bear Branch

*NPDES Dischargers for the Lumber River Basin (as of November 27, 2002)*

Permit	Owner	Facility	County	Region	Type	Class	MGD	Subbasin	Receiving Stream
NC0005801	Georgia-Pacific Corporation	Whiteville Plywood Plant	Columbus	Wilmington	Industrial Process & Commercial	Minor	not limited	03-07-58	Juniper Creek
NC0006785	National Spinning Company	Whiteville Plant	Columbus	Wilmington	Industrial Process & Commercial	Minor	0.03	03-07-58	White Marsh
NC0021610	Town of Clarkton	Clarkton WWTP	Bladen	Fayetteville	Municipal, < 1MGD	Minor	0.24	03-07-58	Brown Marsh Swamp
NC0021865	Town of Chadbourn	Chadbourn WWTP	Columbus	Wilmington	Municipal, Large	Major	1.0	03-07-58	Soules Swamp (Benson Millpond)
NC0021920	City of Whiteville	Whiteville WWTP	Columbus	Wilmington	Municipal, Large	Major	3.0	03-07-58	White Marsh
NC0072168	Georgia-Pacific Corporation	Whiteville Timber Facility	Columbus	Wilmington	Industrial Process & Commercial	Minor	not limited	03-07-58	Soules Swamp (Benson Millpond)
NC0045250	Brunswick County Schools	Bolivia Elementary School	Brunswick	Wilmington	100% Domestic < 1MGD	Minor	0.01	03-07-59	Bolivia Branch
NC0074942	Green's Oyster Company Inc	Green's Oyster Company Incorporated	Brunswick	Wilmington	Industrial Process & Commercial	Minor	0.005	03-07-59	Shallotte River
NC0076830	Lloyd's Oyster Company	Lloyd's Oyster Company	Brunswick	Wilmington	Industrial Process & Commercial	Minor	0.005	03-07-59	Shallotte River

*NPDES Individual Stormwater Permits in the Lumber River Basin (as of January 7, 2003)*

<b>Permit #</b>	<b>Facility Name</b>	<b>Receiving Stream</b>	<b>Subbasin</b>	<b>County</b>
NCS000293	Southern States Cooperative	UT Jacob Swamp	03-07-51	Robeson
NCS000374	Buckeye Lumberton, Inc.	UT Lumber River	03-07-51	Robeson
NCS000236	Industrial and Agricultural Chemical	Walnut Creek	03-07-52	Robeson
NCS000005	Carolmet, Inc.	UT Lumber River	03-07-55	Scotland



## **Appendix II**

### **Biological Water Quality Data Collected by DWQ**



## **Benthic Macroinvertebrate Sampling Methods and Criteria**

### ***Freshwater Wadeable and Flowing Waters***

Benthic macroinvertebrates can be collected from wadeable, freshwater, flowing waters using two sampling procedures. The Division of Water Quality's standard qualitative sampling procedure includes 10 composite samples: two kick-net samples, three bank sweeps, two rock or log washes, one sand sample, one leafpack sample, and visual collections from large rocks and logs (NCDEHNR, 1997). The purpose of these collections is to inventory the aquatic fauna and produce an indication of relative abundance for each taxon. Organisms are classified as Rare (1-2 specimens), Common (3-9 specimens), or Abundant ( $\geq 10$  specimens).

Several data analysis summaries (metrics) can be produced to detect water quality problems. These metrics are based on the idea that unstressed streams and rivers have many invertebrate taxa and are dominated by intolerant species. Conversely, polluted streams have fewer numbers of invertebrate taxa and are dominated by tolerant species. The diversity of the invertebrate fauna is evaluated using taxa richness counts; the tolerance of the stream community is evaluated using a biotic index.

EPT taxa richness (EPT S) is used with DWQ criteria to assign water quality ratings (bioclassifications). "EPT" is an abbreviation for Ephemeroptera + Plecoptera + Trichoptera, insect groups that are generally intolerant of many kinds of pollution. Higher EPT taxa richness values usually indicate better water quality. Water quality ratings also are based on the relative tolerance of the macroinvertebrate community as summarized by the North Carolina Biotic Index (NCBI).

Both tolerance values for individual species and the final biotic index values have a range of 0-10, with higher numbers indicating more tolerant species or more polluted conditions. Water quality ratings assigned with the biotic index numbers are combined with EPT taxa richness ratings to produce a final bioclassification, using criteria for coastal plain streams. EPT abundance (EPT N) and total taxa richness calculations also are used to help examine between-site differences in water quality. If the EPT taxa richness rating and the biotic index differ by one bioclassification, the EPT abundance value is used to determine the final site rating.

Benthic macroinvertebrates can also be collected using an EPT sampling procedure. Four rather than 10 composite qualitative samples are taken at each site: 1 kick, 1 sweep, 1 leafpack and visual collections. Only EPT groups are collected and identified, and only EPT criteria are used to assign a bioclassification.

Both EPT taxa richness and biotic index values also can be affected by seasonal changes. DWQ criteria for assigning bioclassification are based on summer sampling: June - September. For samples collected outside summer, EPT taxa richness can be adjusted by subtracting out winter/spring Plecoptera or other adjustment based on resampling of summer site. The biotic index values also are seasonally adjusted for samples outside the summer season.

Criteria have been developed to assign bioclassifications ranging from Poor to Excellent to each benthic sample. These bioclassifications primarily reflect the influence of chemical pollutants. The major physical pollutant, sediment, is not assessed as well by a taxa richness analysis.

### ***Boat Sampling and Coastal B Criteria***

Coastal B rivers are defined as waters in the coastal plain that are deep (nonwadeable) with little or no visible current under normal or low flow conditions and that have freshwater. Other characteristics may include open canopy, low pH and low dissolved oxygen. These waters require a boat for sampling. These are usually large coastal plain rivers, including the lower sections of the Alligator, Chowan, Meherrin, Neuse, Pasquotank, Perquimans, Roanoke, Tar, South, Black, Waccamaw, Wiccacon, Northeast Cape Fear and Cape Fear Rivers. In such habitats, petite Ponar dredge sampling replaces kick-net samples, but all other standard qualitative collections techniques are still useable.

The standard boat method still aims at a total of 10 composite samples per site:

- Dredges - 3 composite samples using a petite Ponar.
- Sweeps - 3 samples collected from bank habitats, sampling as much of the edge habitat as possible, including aquatic macrophytes, roots and areas of debris.
- Leaf packs/Debris wash - 1 composite sample of leaves and other large particulate organic matter are to be rinsed in a wash bucket.
- Epifaunal collections - 2 composite samples of macrophytes and well-colonized logs both in the current and along the shore.
- Visuals - should cover macrophytes, logs along the shore, and especially logs in the current.

The Biological Assessment Unit has limited data on Coastal B rivers and has had a difficult time gathering more data. Criteria have been developed based only on EPT taxa richness (Table A-II-1), although using biotic index values and total taxa richness values were also evaluated. The criteria that are presented here will continue to be evaluated, and any bioclassifications derived from them should be considered tentative and not used for use support decisions.

### ***Swamp streams***

Swamp streams are located in the coastal plain area and cease flowing during summer low flow periods. This seasonal interruption in flow limits the diversity of the fauna, requiring special criteria to properly rate such streams. The swamp stream sampling method utilizes a variety of collection techniques to inventory the macroinvertebrate fauna at a site. Nine sweep samples (one series of three by each field team member) are collected from each of the habitat types: macrophytes, root mats/undercut banks, and detritus deposits. If one of these habitat types is not present, a sweep from one of the other habitats should be substituted. A sweep for the swamp method is defined as the area that can be reached from a given standing location. Three log/debris washes also are collected. Visual collections are the final technique used at each site.

Samples are picked on site. The primary output for this sampling method is a taxa list with an indication of relative abundance (Rare, Common or Abundant) for each taxon. Sampling during

winter flow periods provides the best opportunity for detecting impacts, and only winter benthos (February and March) data can be used to evaluate swamp streams.

A draft multi-metric system is being developed to evaluate swamp streams, using the NC Biotic Index (BI), habitat score, total taxa richness (S), and EPT abundance (EPT N). The system uses data from the Lumber, White Oak, Cape Fear, Neuse and Tar River basins. Other basins will need different criteria. Swamp streams are divided into two broad types: streams with a distinct channel and streams with a braided channel. EPT abundance and total taxa richness are expected to be lower in braided swamp streams. Stream pH also affects these metrics, and scoring criteria will likely be adjusted for all sites with pH <5.5.

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### ***Flow Measurement***

Changes in the benthic macroinvertebrate community are often used to help assess between-year changes in water quality. Some between-year changes in the macroinvertebrates, however, may be due largely to changes in flow. High flow years magnify the potential effects of nonpoint source runoff, leading to scour, substrate instability and reduced periphyton. Low flow years may accentuate the effect of point source dischargers by providing less dilution of wastes. For these reasons, all between-year changes in the biological communities are considered in light of flow conditions (high, low or normal) for one month prior to the sampling date. Daily flow information is obtained from the closest available USGS monitoring site and compared to the long-term mean flows. High flow is defined as a mean flow >140 percent of the long-term mean for that time period, usually July or August. Low flow is defined as a mean flow <60 percent of the long-term mean, while normal flow is 60-140 percent of the mean. While broad scale regional patterns are often observed, there may be large geographical variation within the state, and large variation within a single summer period.

### ***Habitat Evaluation***

The Division has developed a habitat assessment form to better evaluate the physical habitat of a stream. The habitat score has a potential range of 1-100, based on evaluation of channel modification, amount of instream habitat, type of bottom substrate, pool variety, bank stability, light penetration and riparian zone width. Higher numbers suggest better habitat quality, but no criteria have been developed to assign impairment ratings.

Table A-II-1 Benthic Macroinvertebrate Data, Lumber River Basin, 1983 – 2001  
(Basin sites are in **bold**.)

Waterbody	Location	County	Index No.	Date	ST	EPT	BI	EPTBI	BioClass
<b>03-07-50</b>									
Drowning Cr	SR 1124	Moore	14-2-(1)	02/16/89	35	35	3.45	3.45	Good
White Cedar Br	USGS site	Richmond	14-2-(1)	03/05/86	47	10	5.01	2.97	Good
<b>Jackson Cr</b>	SR 1122	Moore	14-2-5	02/09/84	35	10	4.59	2.78	Good
				07/09/01	---	23	---	3.16	Good
				07/08/96	---	25	---	2.88	Excellent
				02/16/89	---	26	---	3.39	Good-Fair
Naked Cr	SR 1490	Richmond	14-2-6	01/17/90	94	46	4.45	3.30	Excellent
<b>Naked Cr</b>	SR 1003	Richmond	14-2-6	07/13/01	98	41	4.55	3.61	Excellent
				07/08/96	81	33	4.75	3.61	Excellent
				09/09/91	94	35	4.61	2.91	Excellent
				11/07/90	83	31	5.12	3.89	Excellent
				07/17/90	80	34	4.58	3.15	Excellent
				05/09/90	---	39	---	3.45	Excellent
				04/06/90	92	42	4.82	3.12	Excellent
				01/17/90	---	37	---	3.13	Excellent
				02/16/89	---	46	---	3.20	Excellent
				10/23/86	98	33	4.66	2.95	Excellent
				03/01/85	101	35	4.28	2.74	Excellent
				12/12/84	93	37	4.55	2.88	Excellent
				02/09/84	85	35	4.26	2.67	Excellent
				05/18/83	86	32	4.66	3.18	Excellent
Joe's Br	near SR 1003	Richmond	14-2-6	05/09/90	---	16	---	3.10	Excellent
				03/05/85	40	14	4.59	3.60	Good
Rocky Ford Br	SR 1424	Richmond	14-2-6-1	02/09/84	45	13	4.74	3.35	Good
				05/09/90	---	27	---	3.93	Excellent
				07/13/01	81	31	4.51	2.81	Excellent
				07/08/96	74	34	4.57	3.26	Excellent
				09/09/91	90	39	4.50	2.81	Excellent
				02/16/89	---	40	---	2.65	Excellent
				07/14/88	87	30	4.67	2.69	Excellent
				09/11/85	74	28	4.36	2.76	Excellent
<b>Horse Cr</b>	SR 1102	Moore	14-2-10	07/09/01	---	20	---	2.80	Good
				07/08/96	---	28	---	2.78	Excellent
				09/09/91	---	26	---	2.39	Excellent
UT Deep Cr	USGS site	Moore	14-2-10-1-(1)	03/06/86	48	13	5.07	2.90	Excellent
				02/14/84	49	12	4.64	2.72	Excellent
Aberdeen Cr	SR 1102	Moore	14-2-11-(6)	10/08/87	---	23	---	3.17	Good
Aberdeen Cr	below WWTP	Moore	14-2-11-(6)	10/08/87	---	21	---	3.92	Good
Quewhiffle Cr	SR 1214	Hoke	14-2-14	03/05/98	---	7	---	3.56	Not Rated
				04/24/89	40	12	4.94	3.40	Not Rated
				01/30/84	27	4	6.42	3.75	Not Rated
Quewhiffle Cr	SR 1225	Hoke	14-2-14	04/24/89	73	26	4.69	2.99	Good
				01/30/84	79	22	4.74	3.03	Good
Mountain Cr	SR 1219	Hoke	14-2-16-(2)	07/13/01	---	9	---	4.96	Not Rated
Buffalo Cr	SR 1203	Hoke	14-2.5	01/30/84	69	22	5.30	3.99	Good
<b>03-07-51</b>									
<b>Lumber R</b>	SR 1404	Scotland	14-(3)	07/17/01	90	36	4.57	3.45	Excellent
				07/09/96	75	33	4.06	2.98	Excellent
				05/03/94	104	46	4.49	3.18	Excellent
				09/10/91	83	30	5.17	2.99	Excellent
				10/22/86	85	36	5.02	3.62	Excellent
				07/14/86	88	30	5.06	3.69	Excellent
				10/22/85	89	34	5.05	2.84	Excellent

Waterbody	Location	County	Index No.	Date	ST	EPT	BI	EPTBI	BioClass
Lumber R	SR 1433	Scotland	14-(3)	07/14/86	89	30	5.02	3.59	Excellent
				10/22/85	90	29	5.33	3.25	Good
<b>Lumber R</b>	NC 71	Robeson	14-(4.5)	07/17/01	92	34	5.27	4.06	Excellent
				07/09/96	69	27	4.77	3.49	Excellent
				05/03/94	85	29	4.97	3.51	Good
				09/10/91	78	23	5.54	3.84	Good
				08/07/90	92	26	5.88	4.46	Good
				07/13/88	88	29	5.25	3.59	Excellent
				10/22/86	69	27	5.11	3.50	Excellent
				07/17/85	74	22	5.23	4.01	Excellent
				04/03/85	97	36	5.77	3.85	Excellent
Lumber R	SR 1303	Robeson	14-(4.5)	04/03/85	79	32	5.42	3.48	Excellent
Lumber R	SR 1153	Robeson	14-(4.5)	04/03/85	88	38	5.44	3.76	Excellent
Lumber R	SR 1354	Robeson	14-(4.5)	10/22/86	73	26	5.20	3.63	Excellent
				07/14/86	71	25	4.97	3.99	Excellent
<b>Gum Swp</b>	SR 1312	Robeson	14-5	07/17/01	---	15	---	5.73	Not Impaired
				02/08/01	75	21	6.10	4.64	Not Rated
<b>Lumber R</b>	SR 1003	Robeson	14-(7)	07/18/01	92	32	5.10	4.03	Excellent
				07/09/96	71	31	4.79	3.79	Excellent
				09/11/91	86	30	5.79	3.89	Excellent
				08/07/90	87	28	5.37	4.18	Excellent
				07/13/88	88	28	5.20	4.25	Excellent
				10/23/86	82	31	5.21	3.56	Excellent
				07/15/86	84	32	5.27	4.06	Excellent
				07/17/85	84	30	5.31	4.25	Excellent
				07/27/83	95	30	5.43	3.90	Excellent
				07/27/83	79	24	5.29	4.41	Excellent
Lumber R	NC 72/711	Robeson	14-(7)	09/11/91	67	27	5.98	4.48	Good
<b>Back Swp</b>	SR 1003	Robeson	14-8-(2.5)	07/17/01	61	11	6.16	4.81	Not Rated
				02/08/01	80	25	5.90	4.84	Not Rated
Back Swp	US 301	Robeson	14-8-(2.5)	09/11/91	---	15	---	4.85	Good-Fair
<b>Bear Swp</b>	SR 1339	Robeson	14-9-(1.5)	07/18/01	---	11	---	6.31	Not Rated
				02/08/01	79	17	6.22	4.89	Not Rated
				03/14/96	58	20	6.13	5.31	Not Rated
<b>Lumber R</b>	NC 41/72	Robeson	14-(13)	07/18/01	91	30	5.77	4.58	Excellent
				07/10/96	73	30	5.40	4.30	Excellent
Lumber R	SR 2289	Robeson	14-(13)	09/11/91	84	29	5.73	3.86	Good
				07/15/86	73	28	5.79	4.21	Good
				10/23/85	91	29	5.62	3.99	Good
				07/16/85	78	28	6.03	4.56	Good
Lumber R	SR 2202	Robeson	14-(13)	07/16/85	62	15	6.53	3.71	Good-Fair
Lumber R	above WWTP	Robeson	14-(13)	07/16/86	77	22	6.75	4.28	Good-Fair
				10/23/85	75	19	6.63	3.59	Good-Fair
<b>Lumber R</b>	NC 72, below WWTP	Robeson	14-(13)	08/21/01	53	12	6.46	4.61	Good-Fair
				07/11/96	57	15	6.33	4.38	Good-Fair
				07/16/86	43	5	8.08	6.53	Poor
				07/16/85	65	15	7.35	4.18	Good-Fair
<b>Lumber R</b>	US 74	Robeson	14-(21)	09/10/01	92	32	5.64	4.55	Excellent
				07/11/96	82	26	5.58	4.31	Good
				09/10/91	53	20	5.00	4.07	Good
				07/13/88	92	27	5.46	4.32	Excellent
				06/24/86	73	27	5.71	4.45	Good
Lumber R	NC 904	Robeson	14-(21)	07/10/96	81	30	5.06	3.65	Excellent
				09/10/91	69	23	4.96	4.11	Excellent
<b>Porter Swp</b>	SR 1503	Columbus	14-27	02/06/01	49	6	7.51	5.17	Not Rated
				03/15/96	41	6	7.32	3.20	Not Rated
				03/05/92	60	6	7.66	6.94	Not Rated
				09/11/91	---	3	---	6.59	Not Rated

Waterbody	Location	County	Index No.	Date	ST	EPT	BI	EPTBI	BioClass
Gapway Swp	SR 1356	Columbus	14-31	01/06/01	71	11	7.62	6.40	Not Rated
				03/15/96	57	16	7.10	5.98	Not Rated
03-07-52									
Raft Swp	SR 1505	Robeson	14-10-(1)	02/07/01	82	20	5.99	4.33	Not Rated
Big Raft Swp	NC 211	Robeson	14-10-(1)	09/11/91	---	16	---	4.64	Good-Fair
				12/29/88	75	24	6.28	4.82	Good-Fair
L Raft Swp	SR 1776	Robeson	14-10-5	02/21/01	48	8	7.47	7.11	Not Rated
L Raft Swp	SR 1505	Robeson	14-10-5	02/07/01	64	9	7.56	5.78	Not Rated
Big Raft Swp	SR 1526	Robeson	14-10-(5.5)	12/29/88	87	30	6.24	4.98	Good-Fair
Burnt Swp	above RR	Robeson	14-10-8-4-(0.5)	06/04/91	41	4	7.09	5.88	Not Rated
Burnt Swp	SR 1515	Robeson	14-10-8-4-(0.5)	06/04/91	44	5	7.39	5.59	Not Rated
03-07-53									
Big Swp	NC 211	Robeson	14-22	07/10/96	---	15	---	4.24	Good-Fair
				09/23/91	59	14	6.30	3.93	Good-Fair
Big Swp	SR 1002	Robeson	14-22	09/23/91	61	15	6.11	3.70	Good-Fair
Gallberry Swp	NC 20	Robeson	14-22-1	09/12/91	---	19	---	4.40	Good
L Marsh Swp	SR 1907	Robeson	14-22-1-3	02/07/01	67	17	6.03	4.52	Not Rated
Big Marsh Swp	above Croft Metals	Robeson	14-22-2	08/11/92	45	10	6.76	6.11	Not Rated
Big Marsh Swp	below Croft Metals	Robeson	14-22-2	08/11/92	49	10	6.85	5.87	Not Rated
Big Marsh Swp	SR 1924	Robeson	14-22-2	02/07/01	77	20	6.25	4.73	Not Rated
				09/12/91		16		4.67	Not Rated
Jackson Br	SR 2100	Robeson	14-22-3-7	03/04/92	69	10	7.62	5.65	Not Rated
03-07-54									
Ashpole Swp	NC 41	Robeson	14-30	01/30/01	53	11	6.68	5.55	Not Rated
				03/15/96	53	10	6.67	5.84	Not Rated
				09/11/91	---	8	---	5.64	Not Rated
Ashpole Swp	SR 2258	Robeson	14-30	06/24/86	45	3	8.08	7.79	Not Rated
Hog Swp	SR 2262	Robeson	14-30-7	01/31/01	52	11	6.72	6.40	Not Rated
				03/13/96	51	13	6.69	6.10	Not Rated
				09/22/91	---	8	---	6.62	Not Rated
Indian Swp	SR 2255	Robeson	14-30-8	03/04/92	57	4	8.27	5.75	Not Rated
03-07-55									
Gum Swamp Cr	SR 1323	Scotland	14-32-(7)	07/09/01	---	22	---	3.01	Good
				07/10/96	---	15	---	2.71	Good-Fair
				09/09/91	---	17	---	2.86	Good-Fair
Gum Swamp Cr	SR 1319	Scotland	14-32-(10)	02/06/90	51	16	5.33	4.53	Good-Fair
Gum Swamp Cr	below Fieldcrest Mills	Scotland	14-32-(10)	02/06/90	39	17	6.26	4.63	Good-Fair
Gum Swamp Cr	US 15/401	Scotland	14-32-(12)	07/09/01	---	20	---	2.86	Good
				07/09/96	---	21	---	3.45	Good
				09/09/91	---	24	---	3.85	Excellent
Leiths Cr	SR 1610	Scotland	14-33	09/10/91	---	12	---	5.95	Good-Fair
Shoe Heel Cr	SR 1369	Scotland	14-34	09/06/90	82	27	5.70	3.74	Good
Shoe Heel Cr	SR 1612	Scotland	14-34	09/05/90	76	19	6.38	5.06	Good-Fair
Shoe Heel Cr	SR 1101	Robeson	14-34	07/10/01	53	18	4.87	3.44	Good
				07/10/96	68	25	4.53	3.54	Excellent
				09/10/91	75	26	5.47	3.67	Good
				08/07/90	80	28	5.37	3.78	Excellent
				07/07/87	73	24	4.89	5.58	Excellent
				09/17/85	70	21	5.04	3.94	Good



Waterbody	Location	County	Index No.	Date	ST	EPT	BI	EPTBI	BioClass
Jordan Cr	USGS site	Scotland	14-34-4-(1)	03/05/86	43	13	4.83	2.96	Good
				02/23/84	39	11	4.75	3.24	Good
<b>Jordan Cr</b>	US 401	Scotland	14-34-4-(2)	07/09/01	---	12	---	3.54	Good-Fair
				07/10/96	---	15	---	3.17	Good-Fair
<b>03-07-56</b>									
Waccamaw R	below dam	Columbus	15-(1)	06/19/91	55	13	6.36	4.92	Good-Fair
Waccamaw R	Crusoe Island	Columbus	15-(1)	06/19/91	84	28	5.86	4.47	Good
<b>Waccamaw R</b>	SR 1928	Columbus	15-(1)	07/17/01	23	18	5.03	5.14	Good
				06/17/91	78	27	5.27	4.03	Excellent
Big Cr	SR 1947	Columbus	15-2-6	06/18/91	42	2	7.70	7.28	Not Rated
<b>Friar Swp</b>	SR 1740	Columbus	15-2-6-3	02/01/01	49	11	6.72	6.21	Not Rated
				02/18/99	45	10	6.47	5.19	Not Rated
				03/03/98	44	9	6.27	5.78	Not Rated
				02/25/97	48	13	6.51	5.98	Not Rated
				03/13/96	48	12	6.30	6.11	Not Rated
Slap Swp	SR 1740	Columbus	15-2-6-4	03/15/96	45	6	7.29	6.20	Not Rated
<b>03-07-57</b>									
<b>Waccamaw R</b>	NC 130	Columbus	15-(1)	07/17/01	62	22	5.79	4.58	Good
				09/02/97	54	19	6.38	4.55	Good-Fair
				06/17/91	94	27	6.08	4.22	Good
				08/08/90	78	19	6.43	3.34	Good-Fair
				06/07/87	72	19	6.08	4.73	Good-Fair
				07/09/84	90	22	6.21	4.26	Good-Fair
<b>Waccamaw R</b>	NC 904	Columbus	15-(1)	05/09/01	84	21	6.51	5.04	Good-Fair
				07/17/01	---	23	---	4.63	Good
				09/10/91	57	19	6.07	4.50	Good-Fair
				07/26/83	56	7	7.51	5.11	Fair
Juniper Cr	NC 211	Brunswick	15-7	06/18/91	30	3	6.53	5.62	Not Rated
Juniper Cr	SR 1928	Columbus	15-7	06/17/91	50	10	6.50	4.29	Not Rated
Grissett Swp	SR 1173	Columbus	15-17-1-(5)	09/11/91	---	5	---	6.92	Not Rated
<b>Grissett Swp</b>	SR 1141	Columbus	15-17-1-(5)	02/05/01	36	6	7.40	5.53	Not Rated
Monie Swp	SR 1006	Columbus	15-17-1-12	03/27/96	33	6	7.34	6.75	Not Rated
				09/11/91	---	5	---	7.04	Not Rated
Caw Caw Swp	SR 1305	Brunswick	15-23	03/03/98	---	5	---	3.97	Not Rated
				07/09/96	---	5	---	5.72	Not Rated
<b>03-07-58</b>									
White Marsh	above US 74 Bus	Columbus	15-4	09/29/94	49	3	7.32	3.93	Not Rated
White Marsh	old RR grade	Columbus	15-4	09/29/94	38	2	8.06	7.42	Not Rated
<b>White Marsh</b>	SR 1001	Columbus	15-4	02/01/01	33	2	7.05	6.61	Not Rated
Brown Marsh Swp	SR 1700	Bladen	15-4-1-1-1	03/13/96	41	2	7.93	4.92	Not Rated
<b>Elkton Marsh</b>	SR 1710	Bladen	15-4-1-1-2	02/05/01	29	4	6.19	4.19	Not Rated
				03/13/96	37	5	7.15	6.44	Not Rated
Soules Swp	SR 1420	Columbus	15-4-8	03/05/92	63	6	8.25	6.97	Not Rated
<b>03-07-59</b>									
<b>Freshwater sites</b>									
Lockwoods Folly R	SR 1501	Brunswick	15-25-1-(1)	07/08/96	66	14	6.33	5.41	Good-Fair
				07/10/84	67	6	7.79	7.33	Good-Fair
<b>Royal Oak Swp</b>	NC 211	Brunswick	15-25-1-12	07/11/01	---	13	---	5.49	Not Rated
				02/05/01	58	18	6.01	4.56	Not Rated
				02/18/99	75	21	6.41	5.19	Not Rated
				03/03/98	55	18	6.24	4.96	Not Rated
				07/08/96	---	15	---	3.45	Not Rated

Waterbody	Location	County	Index No.	Date	ST	EPT	BI	EPTBI	BioClass
Shallotte R	US 17	Brunswick	15-25-2-(5)	07/11/01	31	6	6.84	6.11	Fair
				07/08/96	50	9	6.29	5.59	Good-Fair
				09/09/91	58	11	6.92	5.79	Good-Fair
				07/13/83	48	7	6.87	5.59	Good-Fair
Estuarine sites									
ICWW	CM 105 #1	Brunswick	15-25	06/25/96	79				Not Rated
ICWW	CM 105 #2	Brunswick	15-25	06/25/96	62				Not Rated
ICWW	CM 105 #3	Brunswick	15-25	06/25/96	92				Not Rated
ICWW	Ocean Isle Canal	Brunswick	15-25	06/25/96	105				Not Rated
Lockwoods Folly R	NC 211	Brunswick	15-25-1-(11)	09/09/91	38				Not Rated
Lockwoods Folly R	CM 14	Brunswick	15-25-1-(16)	06/26/96	51				Not Rated
Shallotte R	Shallotte Cr	Brunswick	15-25-2-(10)	06/26/96	106				Not Rated
Calabash R	CM 7	Brunswick	15-25-5	06/25/96	48				Not Rated

## **Fish Community Sampling Methods and Criteria**

### ***Wadeable Stream Sampling Methods***

At each sample site, a 600-foot section of stream was selected and measured. The fish in the delineated stretch of stream were then collected using two backpack electrofishing units and two persons netting the stunned fish. After collection, all readily identifiable fish were examined for sores, lesions, fin damage or skeletal anomalies, measured (total length to the nearest 1 mm), and then released. Those fish that were not readily identifiable were preserved and returned to the laboratory for identification, examination and total length measurement. Detailed descriptions of the sampling methods may be found in NCDENR (2001) or electronically at <http://www.esb.enr.state.nc.us/BAUwww/IBI%20Methods%202001.pdf>.

### ***Nonwadeable Small Boat Sampling Methods***

At each site, a 400 m section of stream is measured off into 100 m segments. There are four segments along each shoreline and two segments down the center of the stream, for a total of 10 segments. For each of the 100 m segments, fish are collected and processed the same as those collected using the wadeable stream method. The last collection technique used at each location is a timed catfish collection effort outside the measured stream reach. Data from each of the 100-meter segments and the catfish sampling are currently treated as a separate subsample.

### ***NCIBI Analysis***

The scoring criteria, metric performance and fish community ratings are currently being revised for wadeable streams in the Sandhills and coastal plain. Evaluation protocols for nonwadeable streams sampled with the small electrofishing boat are also currently under development.

## **References**

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- Karr, J. R. 1981. *Assessment of Biotic Integrity Using Fish Communities*. Fisheries. 6:21-27.
- NCDENR. 2001. *Stream Fish Community Assessment and Fish Tissue. Standard Operating Procedure Biological Monitoring*. Biological Assessment Unit. Environmental Sciences Branch. Water Quality Section. Division of Water Quality. North Carolina Department of Environment and Natural Resources. Raleigh, NC.

Table A-II-2 Fish Community Structure Data Collected in the Lumber River Basin, 1990 – 2001  
(Current basinwide sites are **bolded**.)

Subbasin	Waterbody	Station	County	Index No.	Date	Rating
<b>03-07-50</b>						
	<b>Drowning Cr</b>	NC 73	Moore	14-2-(1)	03/25/96	Not Rated
					05/31/96	Not Rated
					06/06/01	Not Rated
	<b>Jackson Cr</b>	SR 1122	Moore	14-2-5	06/06/01	Not Rated
	<b>Naked Cr</b>	SR 1003	Richmond	14-2-6	03/25/96	Not Rated
					05/31/96	Not Rated
					06/06/01	Not Rated
	Rocky Ford Br	SR 1424	Richmond	14-2-6-1	08/20/90	Not Rated
	<b>Deep Cr</b>	SR 1113	Moore	14-2-10-1-(1)	06/07/01	Not Rated
	<b>Aberdeen Cr</b>	SR 1105	Moore	14-2-11-(6)	06/07/01	Not Rated
	<b>Quewhiffle Cr</b>	SR 1225	Hoke	14-2-14	06/05/01	Not Rated
	<b>Mountain Cr</b>	SR 1215	Hoke	14-2-16-(2)	06/05/01	Not Rated
	<b>Buffalo Cr</b>	SR 1203	Hoke	14-2.5	06/05/01	Not Rated
<b>03-07-51</b>						
	Gum Swp	NC 71	Robeson	14-5	09/30/91	Not Rated
					03/26/96	Not Rated
	<b>Back Swp</b>	SR 1003	Robeson	14-8-(2.5)	07/24/91	Not Rated
					03/26/96	Not Rated
					05/22/01	Not Rated
	Porter Swp	SR 1503	Columbus	14-27	04/29/92	Not Rated
					03/27/96	Not Rated
	<b>Gapway Swp</b>	SR 1356	Columbus	14-31	05/22/01	Not Rated
<b>03-07-54</b>						
	Ashpole Swp	NC 41	Robeson	14-30	03/26/96	Not Rated
					07/25/91	Not Rated
					10/22/92	Not Rated
<b>03-07-55</b>						
	<b>Gum Swp Cr</b>	SR 1344	Scotland	14-32-(1)	05/24/01	Not Rated
	<b>Joes Cr</b>	NC 79	Scotland	14-32-14	05/24/01	Not Rated
	<b>Shoe Heel Cr</b>	SR 1433	Scotland	14-34	05/23/01	Not Rated
	L Shoe Heel Cr	SR 1405	Scotland	14-34-3	09/30/91	Not Rated
					03/25/96	Not Rated
	<b>Jordan Cr</b>	SR 1324	Scotland	14-34-4-(2)	05/23/01	Not Rated
	<b>Juniper Cr</b>	SR 1405	Scotland	14-34-4-3	05/23/01	Not Rated
<b>03-07-56</b>						
	Friar Swp	SR 1740	Columbus	15-2-6-3	03/27/96	Not Rated
<b>03-07-57</b>						
	Juniper Cr	SR 1928	Columbus	15-7	12/11/91	Not Rated
	Grissett Swp	SR 1141	Columbus	15-17-1-(5)	04/29/92	Not Rated
	Monie Swp	SR 1006	Columbus	15-17-1-12	04/29/92	Not Rated
	Toms Fork Cr	SR 1118	Columbus	15-17-1-10	04/29/92	Not Rated
<b>03-07-58</b>						
	Brown Marsh Swp	SR 1700	Bladen	15-4-1-1	03/27/96	Not Rated
					08/11/92	Not Rated
<b>03-07-59</b>						
	Lockwoods Folly R	US 17	Brunswick	15-25-1-(1)	04/28/92	Not Rated
					04/02/96	Not Rated
	<b>Royal Oak Swp</b>	NC 211	Brunswick	15-25-1-12	04/25/92	Not Rated
					05/21/01	Not Rated
	Cool Run	US 17	Brunswick	15-25-2-3	04/28/92	Not Rated
					04/02/96	Not Rated

## ***Fish Tissue Criteria***

In evaluating fish tissue analysis results, several different types of criteria are used. Human health concerns related to fish consumption are screened by comparing results with Federal Food and Drug Administration (FDA) action levels (USFDA, 1980), Environmental Protection Agency (USEPA) recommended screening values, and criteria adopted by the North Carolina State Health Director (Table A-II-3). Individual parameter results which appear to be of potential human health concern are evaluated by the NC Division of Occupational and Environmental Epidemiology by request from DWQ.

The FDA levels were developed to protect humans from the chronic effects of toxic substances consumed in foodstuffs, and thus, employ a "safe level" approach to fish tissue consumption. Presently, the FDA has only developed metals criteria for mercury.

The USEPA has recommended screening values for target analytes which are formulated from a risk assessment procedure (USEPA, 1995). These are the concentrations of analytes in edible fish tissue that are of potential public health concern. The DWQ compares fish tissue results with USEPA screening values to evaluate the need for further intensive site-specific monitoring.

The North Carolina State Health Director has adopted a selenium limit of 5 µg/g for issuing an advisory. Although the USEPA has suggested a screening value of 0.7 ppt (pg/g) for dioxins, the State of North Carolina currently uses a value of 3.0 ppt in issuing an advisory.

Table A-II-3 Fish Tissue Criteria (All wet weight concentrations are reported in parts per million (ppm, µg/g), except for dioxin which is in parts per trillion (ppt, pg/g)).

<b>Contaminant</b>	<b>FDA Action Levels</b>	<b>US EPA Screening Values</b>	<b>NC Health Director</b>
<b><i>Metals</i></b>			
Cadmium		10.0	
Mercury	1.0	0.6	0.4
Selenium		50.0	5.0
<b><i>Organics</i></b>			
Aldrin	0.3		
Chlorpyrifos		30.0	
Total chlordane		0.08	
Cis-chlordane	0.3		
Trans-chlordane	0.3		
Total DDT <sup>1</sup>		0.3	
o,p DDD	5.0		
p, p DDD	5.0		
o,p DDE	5.0		
p,p DDE	5.0		
o,p DDT	5.0		
p,p DDT	5.0		
Dieldrin		0.007	
Dioxins (total)		0.7	3.0
Endosulfan (I and II)		60.0	
Endrin	0.3	3.0	
Heptachlorepoxyde		0.01	
Hexachlorobenzene		0.07	
Lindane		0.08	
Mirex		2.0	
Total PCBs		0.01	
PCB-1254	2.0		
Toxaphene		0.1	

<sup>1</sup> Total DDT includes the sum of all its isomers and metabolites (i.e., p,p DDT, o,p DDT, DDE and DDD).

<sup>2</sup> Total chlordane includes the sum of cis-and trans- isomers as well as nonachlor and oxychlordane.

Table A-II-4 Wet Weight Concentrations of Mercury (Hg), Arsenic (As), Chromium (Cr), Copper (Cu), Nickel (Ni) and Zinc (Zn) in Fish Tissue from the Lumber River at US 74 (Subbasin 51), near Boardman, Columbus County, July 2000

Species	Length (mm)	Weight (g)	Hg (µg/kg)	As (µg/kg)	Cr (µg/kg)	Cu (µg/kg)	Ni (µg/kg)	Zn (µg/kg)
<i>Amia calva</i>	410	663	0.50	0.18	0.19	0.18	ND	ND
	530	1532	1.2	0.28	0.23	ND	ND	0.86
	550	1853	1.2	0.43	0.29	0.12	ND	1.5
	522	1490	1.4	0.30	0.29	0.13	ND	0.57
	590	2256	1.5	0.34	0.26	0.14	ND	1.8
<i>Esox niger</i>	340	365	0.62	ND	0.30	0.17	ND	4.1
	306	190.5	0.64	ND	0.24	0.17	ND	6.1
	435	554	0.67	ND	0.25	0.10	ND	3.0
	294	185.5	0.70	ND	0.27	0.16	0.15	5.4
	307	212	0.89	ND	0.18	0.19	ND	5.9
	375	388	0.92	ND	0.27	0.14	ND	4.2
<i>Ictalurus punctatus</i>	495	1291	0.58	ND	0.26	0.19	ND	2.6
<i>Lepomis microlophus</i>	208	207.5	0.30	ND	0.21	0.15	ND	6.4
	250	357	0.30	ND	0.25	0.52	ND	4.0
	230	290.5	0.43	ND	0.28	0.18	ND	3.5
	250	388	0.66	ND	0.25	0.36	ND	2.5
<i>Micropterus salmoides</i>	275	327	0.72	ND	0.24	0.19	ND	4.2
	302	453	0.86	ND	0.22	0.31	0.51	2.7
	440	1303	1.8	ND	0.23	0.19	ND	1.4
<i>Minytrema melanops</i>	475	1617	0.50	ND	0.31	0.14	ND	2.0
	450	1187	0.51	ND	0.25	0.14	ND	3.0
<i>Pomoxis nigromaculatus</i>	270	328	0.79	ND	0.23	0.22	ND	5.5

Cadmium and lead were non-detectable in all samples.

ND = non-detect; detection level for arsenic and nickel = 0.1 µg/kg, and detection level for zinc = 0.4 µg/kg.

## Lake Sampling Methodology

Lake monitoring stations are sited to provide representative samples of lake water quality based on morphology, size and site-specific considerations. Physical field measurements (dissolved oxygen, pH, water temperature and conductivity) are made with a calibrated Hydrolab<sup>TM</sup>. Readings are taken at the surface of the lake (0.15 meters) and at one-meter increments to the bottom of the lake. Secchi depths are measured at each sampling station with a weighted Secchi disk attached to a rope marked off in centimeters. Surface water samples (0.15 meters) are collected for chloride, hardness, fecal coliform bacteria and metals.

A Labline<sup>TM</sup> sampler is used to composite water samples within the photic zone (a depth equal to twice the Secchi depth). Nutrients, chlorophyll *a*, solids, turbidity and phytoplankton are collected at this depth. Nutrients and chlorophyll *a* from the photic zone are used to calculate the North Carolina Trophic State Index score. The Labline<sup>TM</sup> sampler is also used to collect a grab water samples near the bottom of the lake for nutrients. Water samples are collected and preserved in accordance with protocols specified in the Standard Operating Procedures Manual, Physical and Chemical Monitoring (NCDEHNR, February 1996 and subsequent updates).

## **Appendix III**

### **Use Support Methodology and Use Support Ratings**





# Multiple-Category Use Support Methods

## A. Introduction to Use Support

Surface waters are classified according to their best intended uses. Determining how well a waterbody supports its uses (*use support* status) is an important method of interpreting water quality data and assessing water quality.

Surface waters are rated *Supporting and Impaired*. These ratings refer to whether the classified uses of the water (such as water supply, aquatic life protection and recreation) are being met. For example, waters classified for fish consumption, aquatic life protection and secondary recreation (Class C for freshwater or SC for saltwater) are rated Supporting if data used to determine use support meet certain criteria. Waters are rated as Impaired if these criteria were not met. Waters with inconclusive data are listed as Not Rated. Waters lacking data are listed as No Data. More specific methods are presented in Part C of this appendix.

In previous use support assessments, surface waters were rated fully supporting (FS), partially supporting (PS), not supporting (NS) and not rated (NR). FS was used to identify waters that were meeting their designated uses. Impaired waters were rated PS and NS, depending on their degree of degradation. NR was used to identify waters lacking data or having inconclusive data. The 2002 Integrated Water Quality Monitoring and Assessment Report Guidance issued by the US Environmental Protection Agency (EPA) requested that states no longer subdivide the Impaired category. In agreement with this guidance, North Carolina no longer subdivides the Impaired category and rates waters as Supporting, Impaired, Not Rated or No Data.

Historically, the Supporting use support rating was also subdivided into fully supporting (FS) and fully supporting but threatened (ST). ST was used to identify waters that were fully supporting but had some notable water quality concerns and could represent constant, degrading or improving water quality conditions. North Carolina's past use of ST was very different from that of the EPA, which uses the rating to identify waters that demonstrate declining water quality conditions (EPA Guidelines for Preparation of the Comprehensive State Water Quality Assessments [305(b) Reports] and Electronic Updates, 1997). Given the difference between the EPA and North Carolina definitions of ST and the resulting confusion that arose from this difference, North Carolina no longer subdivides the Supporting category. However, these waters and the specific water quality concerns are identified in the Section B subbasin chapters so that data, management and the need to address the identified concerns are presented.

## B. Interpretation of Data and Information

Data used in use support assessments include biological, chemical/physical, lakes assessments, fish consumption advisories from the NC Department of Health and Human Services, and swimming advisories and shellfish sanitation growing area classifications from the NC Division of Environmental Health (as appropriate). Available land cover and land use information is also used, along with annual water supply reports from regional water treatment plant consultants.

Although there is a general procedure for analyzing the data and information for determining use support ratings, each waterbody is reviewed individually, and best professional judgment is applied during these determinations.

When interpreting the use support ratings, it is important to understand its associated limitations and degree of uncertainty. The assessments are not intended to provide precise conclusions about pollutant budgets for specific watersheds. Rather, the intent of use support assessments is to gain an overall picture of water quality for the five-year assessment window, to describe how well surface waters support the uses for which they were classified, and to document the potential contribution made by different pollution sources.

It is also important to understand that use support methods continue to improve over time, and the information and technology used to make use support determinations also continues to become more accurate. These improvements sometimes make it difficult to make generalizations comparing water quality between basin plans. However, technology and methods improvements result in more scientifically sound use support assessments.

### C. Assessment Methodology

Beginning in 2000 with the *Roanoke River Basinwide Water Quality Plan*, DWQ assesses ecosystem health and human health risk using six use support categories: aquatic life, fish consumption, primary/secondary recreation, water supply, shellfish harvesting and "other" uses. These categories are tied to the uses associated with the primary classifications applied to NC rivers and streams. A single water could have more than one use support rating corresponding to one or more of the six use support categories, as shown in the table below. For many waters, a use support category will not be applicable (N/A) to the classification of that water (e.g., shellfish harvesting is only applied to Class SA waters). A full description of the classifications is available in the DWQ document: *Classifications and Water Quality Standards Applicable to Surface Waters of North Carolina* (15A NCAC 2b .0100 and .0200).

Primary Classification	Use Support Categories					
	Ecosystem Approach	Human Health Approach				
	Aquatic Life	Fish Consumption	Primary/ Secondary Recreation	Water Supply	Shellfish Harvesting	
C	X	X	X	N/A	N/A	X
SC	X	X	X	N/A	N/A	X
B	X	X	X	N/A	N/A	X
SB	X	X	X	N/A	N/A	X
SA	X	X	X	N/A	X	X
WS I – WS IV	X	X	X	X	N/A	X

Many types of information are used to determine use support ratings and to identify causes and sources of water quality impairment. A use support data file is maintained for each of the 17

river basins. All existing data pertaining to a stream segment for each applicable use support category are entered into record and include, but are not limited to, use support ratings, basis of assessment, biological data, ambient monitoring data, problem parameters and potential sources. The following describes the data and methodologies used to make use support assessments for the surface water classifications (described in Section A, Chapter 3 of each basin plan) using the six use support categories. These methods will continue to be refined as additional information becomes available.

### *Basis of Assessment*

Assessments are made on an overall basis of either monitored (M) or evaluated (E), depending on the level of information available. A monitored rating is based on the most recent five-year data window and site-specific data and is therefore treated with more confidence than an evaluated rating.

Summary of Basis for Assigning Use Support Ratings to Surface Waters			
Use Support Status	Overall Basis	Specific Basis	Description
Supporting/ Impaired	Monitored	Monitored (M)	Monitored stream segments <sup>a</sup> with data <sup>b</sup> ≤5 <sup>c</sup> years old where a bioclassification has been assigned to the sampling site and/or ambient and/or fish tissue data exist and/or DEH shellfish growing area data and/or information on posted swimming closures are available; may be applied to any use support category being assessed.
Not Rated		Monitored (M)	Monitored stream segments <sup>a</sup> with data <sup>b</sup> ≤5 <sup>c</sup> years old where a bioclassification has not been assigned to the sampling site; can only be applied to the Aquatic Life use support category.
Supporting		Monitored/ Evaluated (ME)	Stream segment <sup>a</sup> is not monitored, but is assigned a use support rating based on another segment of same stream for which data <sup>b</sup> ≤5 <sup>c</sup> years old are available where a bioclassification has been assigned to the sampling site and/or ambient data are available and the segment is given a Supporting rating; can only be applied to the Aquatic Life use support category.
Supporting	Evaluated	Evaluated (E)	Applied to unmonitored streams that are direct or indirect tributaries to monitored stream segments rated Supporting in the Aquatic Life use support category that share similar land use to the monitored stream segment; waters in the Water Supply use support category where no significant problems have been noted in the Regional Surface Water Supply Reports; waters in the Fish Consumption use support category in river basins within the regional fish consumption advice area.
Impaired		Evaluated (E)	Only applied to waters in the Fish Consumption use support category in river basins within the regional fish consumption advice area.
Not Rated		Evaluated (E)	Unmonitored streams that receive effluent from a NPDES discharger that has been found to be in "significant noncompliance" or has failed three or more WET tests during the two-year review period; only applied to the Aquatic Life use support category.
No Data (ND)			Insufficient or no data available to determine use support; includes unmonitored streams that are direct or indirect tributaries to stream segments rated Impaired.

- A stream segment is a stream, or a portion thereof, listed in the Classifications and Water Quality Standards for a river basin. Each segment is assigned a unique identification number (index number).
- Major data sources include benthic macroinvertebrate and fish community bioclassifications and chemical/physical monitoring data.
- From the year that basin monitoring was done.

Supporting ratings are extrapolated up tributaries from monitored streams when there are no problematic dischargers with permit violations or changes in land use/cover. Supporting ratings may also be applied to unmonitored tributaries where there is little land disturbance (e.g., national forests and wildlife refuges, wilderness areas or state natural areas). Problem parameters or sources (except general NPS) are not applied to unmonitored tributaries. Impaired ratings are not extrapolated to unmonitored tributaries.

### *Problem Parameters*

Where an ambient parameter is identified as a potential concern, the parameter is listed in the DWQ database and use support summary table. Where habitat degradation is identified by DWQ biologists based on site visits, it is listed and attempts are made to identify the type of habitat degradation (e.g., sedimentation, loss of woody habitat, loss of pools, loss of riffles, channelization, lack of riparian vegetation, streambed scour and bank erosion). Habitat evaluation methods are being developed to better identify specific types of habitat degradation.

### *Potential Sources*

General nonpoint sources (NPS) and point sources (PS) of pollution are identified where there is sufficient information.

### **Aquatic Life Use Support**

The aquatic life use support category is an ecosystem approach to assess whether aquatic life (benthic macroinvertebrates and fish) can live and reproduce in the waters. This category is applied to all waters of the state. Biological data, ambient monitoring data and NPDES discharger data are all considered in assessing the aquatic life use support category. The following is a description of each data type and methods used to assess how well a water is meeting the criteria for aquatic life protection.

### *Biological Data*

There are two main types of biological data: benthic macroinvertebrate and fish community. Where recent data for both benthic macroinvertebrates and fish communities are available, both are evaluated in assessing use support. It is important to note that where both ambient monitoring data and biological data are available, biological data are given greater weight. This is particularly true when ambient chemical and biological data are conflicting. When these two indicators conflict, additional information is gathered (e.g., land use and land use changes, etc.) and best professional judgement is used to determine an appropriate use support rating.

In special situations, where there are currently insufficient biological data available, the basinwide planner will make a request of the DWQ Environmental Sciences Branch to determine whether a biological survey is appropriate. If a biological survey is appropriate, the use support rating will be determined by the bioclassification resulting from the survey. If a biological survey is not appropriate, then the stream will be Not Rated.

### Benthic Macroinvertebrate Bioclassifications

Criteria have been developed to assign bioclassifications ranging from Poor to Excellent to most benthic macroinvertebrate samples based on the number of taxa present in the pollution intolerant aquatic insect groups of *Ephemeroptera*, *Plecoptera* and *Trichoptera* (EPTs) and the Biotic Index (BI), which summarizes tolerance data for all taxa in each collection. The benthic macroinvertebrate bioclassifications are translated into use support ratings according to the following scheme:

<u>Bioclassification</u>	<u>Use Support Rating</u>
Excellent	Supporting
Good	Supporting
Good-Fair	Supporting
Fair	Impaired
Poor	Impaired

Due to the increased emphasis placed on Fair or Poor bioclassifications and the borderline nature of some bioclassification scores, sites should be resampled within 12 to 24 months after a Fair rating is obtained in 1999 and beyond, if this Fair rating will result in a lower use support rating or if data are from a site never sampled before. This resampling will be done to validate the Fair bioclassification. Such sites will not be given a use support rating until the second sample is obtained. The table below shows how a final use support rating is obtained for sites that are resampled.

New Benthic Macroinvertebrate Classifications (1999 and Beyond) and Data Causing a Decline in Use Support Ratings				
Pre-1999 Bioclassification	1 <sup>st</sup> Sample Bioclassification	Draft Use Support Rating	2 <sup>nd</sup> Sample Bioclassification	Final Use Support Rating
N/A	Fair	Not Rated; resample	Good-Fair, Good or Excellent	Supporting
N/A	Fair	Not Rated; resample	Fair or Poor	Impaired
N/A	Poor	Impaired	N/A	Impaired
Good-Fair, Good or Excellent	Fair	Not Rated; resample	Good-Fair, Good or Excellent	Supporting
Good-Fair, Good or Excellent	Fair	Not Rated; resample	Fair or Poor	Impaired
Good-Fair, Good or Excellent	Poor	Impaired	N/A	Impaired

N/A – Not Applicable    NR = Not Rated

The use of benthic macroinvertebrate data can be limited in some waters. The accumulation of swamp stream data over nearly a decade suggests that not all swamp streams support similar fauna. The development of swamp stream criteria is complex, and one set of criteria is not appropriate for all swamp streams. Benthic macroinvertebrate data will not be used in waters characterized or classified by DWQ as swamp waters until the bioclassification criteria for these waters can be used with confidence. Benthic macroinvertebrate data are also not used to develop

use support ratings for estuarine waters. Until bioclassification criteria for swamp and estuarine waters are developed, a designation of Not Rated will be used, and these waters will be listed as Not Rated for aquatic life use support assessments.

Benthic macroinvertebrate data are used to provide bioclassifications for high elevation trout streams. The benthic macroinvertebrate data, while not a direct measure of the trout population, are a robust measure of stream integrity. Loss of canopy, increase in stream temperature, increased nutrients, toxicity and increased sedimentation will affect the benthic macroinvertebrate and fish communities. For these reasons, the benthic macroinvertebrate bioclassifications provide a valuable assessment of the integrity of trout waters.

A designation of Not Impaired may be used for flowing waters that are too small to be assigned a bioclassification (less than 4 meters in width), but meet the criteria for a Good-Fair or higher bioclassification using the standard qualitative and EPT criteria. This designation will translate into a use support rating of Supporting.

### *Fish Community Bioclassifications*

The North Carolina Index of Biotic Integrity (NCIBI) is a method for assessing a stream's biological integrity by examining the structure and health of its fish community. The NCIBI incorporates information about species richness and composition, indicator species, trophic function, abundance and condition, and reproductive function. The NCIBI is translated into use support ratings according to the following scheme:

<u>NCIBI</u>	<u>Use Support Rating</u>
Excellent	Supporting
Good	Supporting
Good-Fair	Supporting
Fair	Impaired
Poor	Impaired

The NCIBI was recently revised by DWQ (NCDENR, 2001). Currently, the focus of using and applying the NCIBI is restricted to wadeable streams that can be sampled by a crew of four persons. Infrequently, larger wadeable streams can be sampled if there is a crew of six persons. The bioclassifications and criteria have also been recalibrated against regional reference site data (NCDENR, 2000a, 2000b and 2001a).

NCIBI criteria are applicable only to wadeable streams in the following river basins: Broad, Catawba, Savannah, Yadkin-Pee Dee, Cape Fear, Neuse, Roanoke, Tar-Pamlico, French Broad, Hiwassee, Little Tennessee, New and Watauga. Additionally, the NCIBI criteria are only applicable to streams in the piedmont portion of the Cape Fear, Neuse, Roanoke and Tar-Pamlico River basins. The definition of the "piedmont" for these four river basins is based upon a map of North Carolina watersheds (Fels, 1997). Specifically:

- In the Cape Fear River basin – all waters except for those draining the Sandhills in Moore, Lee and Harnett counties and the entire basin upstream of Lillington, NC.

- In the Neuse River basin -- the entire basin above Smithfield and Wilson, except for the south and southwest portions of Johnston County and eastern two-thirds of Wilson County.
- In the Roanoke River basin -- the entire basin in North Carolina upstream of Roanoke Rapids, NC and a small area between Roanoke Rapids and Halifax, NC.
- In the Tar-Pamlico River basin -- the entire basin above Rocky Mount, except for the lower southeastern one-half of Halifax County and the extreme eastern portion of Nash County.

NCIBI criteria have not been developed for:

- Streams in the Broad, Catawba, Yadkin-Pee Dee, Savannah, French Broad, Hiwassee, Little Tennessee, New and Watauga River basins which are characterized as wadeable first to third order streams with small watersheds, naturally low fish species diversity, coldwater temperatures, and high gradient plunge-pool flows. Such streams are typically thought of as "Southern Appalachian Trout Streams".
- Wadeable streams in the Sandhills ecoregion of the Cape Fear, Lumber and Yadkin-Pee Dee River basins.
- Wadeable streams and swamps in the coastal plain region of the Cape Fear, Chowan, Lumber, Neuse, Pasquotank, Roanoke, Tar-Pamlico and White Oak River basins.
- All nonwadeable and large streams and rivers throughout the state.

Due to the increased emphasis placed on Fair or Poor bioclassifications and the borderline nature of some bioclassification scores, sites should be resampled within 12 to 24 months after a Fair rating is obtained in 1999 and beyond, if this Fair rating will result in a lower use support rating or if data are from a site never sampled before. This resampling will be done to validate the Fair bioclassification. Such sites will not be given a use support rating until the second sample is obtained. The table below shows how a final use support rating is obtained for sites that are resampled.

New Fish Community Classifications (1999 and Beyond) and Data Causing a Decline in Use Support Ratings				
Pre-1999 Bioclassification	1 <sup>st</sup> Sample Bioclassification	Draft Use Support Rating	2 <sup>nd</sup> Sample Bioclassification	Final Use Support Rating
N/A	Fair	Not Rated; resample	Good-Fair, Good or Excellent	Supporting
N/A	Fair	Not Rated; resample	Fair or Poor	Impaired
N/A	Poor	Impaired	N/A	Impaired
Good-Fair, Good or Excellent	Fair	Not Rated; resample	Good-Fair, Good or Excellent	Supporting
Good-Fair, Good or Excellent	Fair	Not Rated; resample	Fair or Poor	Impaired
Good-Fair, Good or Excellent	Poor	Impaired	N/A	Impaired

N/A – Not Applicable

NR = Not Rated

## ***Ambient Monitoring Data***

Chemical/physical water quality data are collected through the DWQ Ambient Monitoring System. These data are downloaded from the Surface Water Information Management System for analysis. Total number of samples and percent of samples exceeding the NC water quality standards are evaluated for the development of use support ratings along with other data or alone when other data are not available. Where both ambient data and biological data are available, biological data are given greater weight.

When reviewing ambient data, a five-year window that ends on August 31 of the year of biological sampling is used. For example, if biological data are collected in a basin in 2000, then the five-year window for the ambient data would be September 1, 1995 to August 31, 2000. Selected ambient parameters are used to assess aquatic life use support. These parameters include ammonia, dissolved oxygen, pH, chloride, arsenic, cadmium, chromium, nickel and lead. These parameters are measured against standards for a minimum of ten samples as follows:

<u>Standards Violation</u>	<u>Rating</u>
Criterion exceeded $\leq 10\%$	Supporting
Criterion exceeded 11-25%	Impaired

Data for copper, iron and zinc are not used according to the scheme outlined above. These metals have action level standards because they are generally not bioaccumulative and have variable toxicity to aquatic life depending on chemical form, solubility and stream characteristics. In order for an action level standard to be violated, there must be a toxicological test that documents an impact on a sensitive aquatic organism. The action level standard is used to screen waters for potential problems with copper, iron and zinc.

Metals data for copper and iron are screened at the 85<sup>th</sup> percentile of five years of ambient data ending on August 31 of the year of biological sampling. Sites, other than estuarine and swamp waters, with an 85<sup>th</sup> percentile of  $\geq 20$   $\mu\text{g/l}$  of copper and/or  $\geq 2000$   $\mu\text{g/l}$  of iron are identified and flagged for instream chronic toxicity testing by DWQ. Chronic toxicity testing in estuarine and swamp waters is not ecologically meaningful. Criteria are still being developed for zinc. If a stream does not have biological data that would deem a Supporting rating, then the stream can be rated Impaired for aquatic life if instream chronic toxicity is found. Criteria for evaluating instream chronic toxicity are three chronic pass/fail tests over three months using *Ceriodaphnia*. Two fails result in an Impaired rating.

It is important to note that some waters may exhibit characteristics outside the numerical standards due to natural conditions (e.g., many swamp waters are characterized by low pH and dissolved oxygen). These natural conditions do not constitute a violation of water quality standards.

## ***NPDES Discharger Data***

### ***Aquatic Toxicity Data***

For facilities that perform Whole Effluent Toxicity (WET) tests according to state NPDES discharge permit requirements, a review of the results of a five-year window that ends on August



31 of the year of biological sampling is used. For example, if biological data are collected in a basin in 2000, then the five-year window for the aquatic toxicity data would be September 1, 1995 to August 31, 2000. If a stream with a WET test facility has not been sampled for instream chronic toxicity, biological community data or has no ambient data, and that facility has failed three or more WET tests in the most recent two years, the stream is Not Rated. If failures continue, DWQ will work with the facility to correct the failures and assess stream impacts before the next basin sampling cycle begins with either a biological survey or instream chronic toxicity testing, if possible.

#### Discharge Effluent Data

NPDES effluent data are reviewed by analyzing monthly averages of water quality parameters over a two-year period of data ending on August 31 of the year of biological sampling in a basin. Prior to May 31, 2000, facilities were screened for criterion 40 percent in excess of state water quality standards for conventional pollutant limitations or 20 percent in excess of state water quality standards for toxic pollutants for two or more months during two consecutive quarters, or chronic violations of either conventional or toxic pollutant limitations for four or more months during two consecutive quarters.

After May 31, 2000, facilities are screened for criterion 20 percent in excess of state water quality standards for both conventional and toxic pollutants for two or more months during two consecutive quarters, or chronic violations of either conventional or toxic pollutant limitations for four or more months during two consecutive quarters. Streams with discharges that are in excess of permit limits will not be rated if no biological or ambient monitoring data are available. Therefore, streams will not be rated Impaired based on effluent data alone. Appropriate DWQ staff will be given a list of these facilities for follow-up.

#### **Fish Consumption Use Support**

The fish consumption use support category is a human health approach to assess whether humans can safely consume fish from a water. This use support category is applied to all waters of the state. The use support rating is assigned using fish consumption advisories or advice as issued by the NC Department of Health and Human Services (NCDHHS). If a limited fish consumption advisory or a no consumption advisory is posted at the time of use support assessment, the water is rated Impaired.

The NCDHHS has developed regional fish consumption advice (all water south and east of I-85) for certain fish species shown to have elevated levels of mercury in their tissue. These fish species include shark, swordfish, king mackerel and tilefish, as well as largemouth bass, bowfin (or blackfish) and chain pickerel (or jack). This regional advice is used to determine use support for the fish consumption category. It is recognized that bowfin only live and reproduce in waters of the piedmont and coastal plain. Therefore, the use support ratings will be based on the combination of the current regional fish consumption advice and the documented presence of bowfin in each river basin as found in *Freshwater Fisheries of North Carolina* (Menhinick, 1991). In river basins where there are documented populations of bowfin (Roanoke, Chowan, Pasquotank, White Oak, Lumber, Neuse, Tar-Pamlico, Cape Fear, Yadkin-Pee Dee and Catawba), all waters will be rated Impaired for the fish consumption category. In river basins where there are no documented populations of bowfin (Little Tennessee, Hiwassee, Savannah,

Watauga, New, French Broad and Broad), the waters will be rated Supporting for the fish consumption category unless there is a site-specific advisory.

In order to separate this regional advice from other fish consumption advisories and to identify actual fish populations with high levels of mercury, only waters with fish tissue monitoring data are presented on the use support maps and in the use support summary tables of the basin plans. A review of the methods for assessing the fish consumption use support category is being conducted and these methods may be modified in the future.

### **Primary/Secondary Recreation Use Support**

This human health related use support category evaluates waters for the support of primary recreation activities such as swimming, water-skiing, skin diving and similar uses usually involving human body contact with water where such activities take place in an organized manner or on a frequent basis. Waters of the state designated for supporting these uses are classified as Class B, SB and SA waters. This use support category also evaluates whether waters support secondary recreation activities such as wading, boating and other uses not involving human body contact with water, and activities involving human body contact with water where such activities take place on an infrequent, unorganized or incidental basis. Waters of the state designated for supporting these uses are classified as Class C, SC and WS waters. The use support ratings applied to this category are based on the North Carolina water quality standard for fecal coliform bacteria where data are available or where swimming advisories are posted by local and state health agencies.

Water quality standards for fecal coliform bacteria are intended to ensure safe use of waters for recreation (refer to Administrative Code Section 15A NCAC 2B .0200). The North Carolina fecal coliform bacteria standard is not to exceed the geometric mean of 200 colonies per 100 ml of at least five samples over a 30-day period and not to exceed 400 colonies per 100 ml in more than 20 percent of the samples during the same period. The 200 colonies per 100 ml standard is intended to ensure that waters are safe enough for water contact through recreation.

Beginning in the summer of 1997, the Division of Environmental Health (DEH) began testing coastal recreation waters (beaches) for fecal coliform bacteria levels to assess the relative safety of these waters for swimming. The Shellfish Sanitation Section of DEH routinely tests approximately 275 coastal sites once a week during the tourist recreational season (April to September), less often the rest of the year. These tests give researchers and the public a gauge of bacteria levels along the North Carolina coast. If an area has elevated bacteria levels, health officials will advise that people not swim there by posting a swimming advisory in the area, and by notifying the local media and county health department.

The Division of Water Quality (DWQ) does not have a comprehensive weekly monitoring program to assess inland waters for fecal coliform bacteria levels. North Carolina has more than 37,000 miles of inland waters, and resources are not sufficient to perform comprehensive weekly bacteria monitoring. Rather, DWQ conducts monthly ambient water quality monitoring at approximately 375 locations across the state. These monthly samplings include fecal coliform bacteria testing of selected lakes, rivers and streams. Ambient water quality samples are routinely collected and sent to DWQ laboratories for analysis using EPA approved laboratory methods, with the exception that sample holding times are not typically within the prescribed

six-hour limit. These data collection and analysis restrictions may impact the quality assurance of the sample results.

Because use support decisions are made in conjunction with the development of DWQ's basinwide water quality management strategies, all available information and data are evaluated for use support ratings using a five-year assessment period. A five-year data window that ends on August 31 of the year of biological sampling is used. For example, if biological data are collected in a basin in 2000, then the five-year window for the fecal coliform data and swimming advisories would be September 1, 1995 to August 31, 2000. However, an annual screening review of all DWQ ambient fecal coliform data is conducted by DWQ to assess the need for additional monitoring or the need for immediate action by the local or state health agencies to protect public health. In most cases, management strategies to correct waters considered to be Impaired due to elevated fecal coliform bacteria levels may require substantial resources and time. Therefore, impairment decisions for bacteria must be made using sound science and data.

Decades of monitoring experience have demonstrated that bacteria concentrations may fluctuate widely in surface waters over a period of time. Thus, a five-year data window and multiple sampling efforts are used to evaluate waters against the North Carolina water quality standard for recreational use support. This level of sampling is needed before waters should be considered Impaired, and therefore, in need of TMDL's or other management strategies. This procedure, however, does not preclude any health agency from immediately posting health advisories to warn recreational users of a temporary increase in health risks related to bacterial contamination or other health related episodes.

Each March, DWQ staff will review bacteria data collections from ambient monitoring stations statewide for the previous sampling year. Locations with annual geometric means greater than 200 colonies per 100 ml, or when more than 20 percent of the samples are greater than 400 colonies per 100 ml, are identified for potential follow-up monitoring conducted five times within 30 days as specified by the state fecal coliform bacteria standard. In addition, appropriate health agencies are notified of these locations. If an initial five times within 30 days sampling indicates a geometric mean greater than 200 colonies per 100 ml, or more than 20 percent of these samples exceed 400 colonies per 100 ml, then the location will continue to be sampled for bacteria persistence. If bacteria concentrations exceed either portion of the state standard, the data are sent to DEH and the local county health director to determine the need for posting swimming advisories. DWQ regional offices will also be notified.

Due to limited resources, and the higher risk to human health, primary recreation waters (Class B, SB and SA) will be given monitoring priority for additional five times within 30 days sampling. Follow-up water quality sampling for Class C waters will be performed as resources permit. Any waters on the 303(d) list of Impaired waters for fecal coliform will receive a low priority for additional monitoring because these waters will be further assessed for TMDL development.

Recreational use support decisions are based on a review of both DWQ and DEH monitoring data for the five-year data window. A formal solicitation for readily available and suitable fecal coliform bacteria monitoring data from other sources is conducted in accordance with EPA Section 303(d) guidance. Recreational use support assessments include an annual review of all readily available DWQ ambient monitoring data and may include additional sampling of five

times within 30 days. The use support impairment status of any given water and the resulting listing of that water on the State 303(d) List will be determined using two procedures.

Monitored Class B, SB and SA waters are rated Supporting for primary recreation if the geometric mean over the five-year data window is less than or equal to 200 colonies per 100 ml, and if less than 20 percent of these samples did not exceed 400 colonies per 100 ml. These waters will be rated Impaired if either portion of these state standards are not met, or if additional five times within 30 days sampling exceeded either portion of the state standard. Monitored Class C, SC and WS waters are rated Impaired if a fecal coliform standard has been exceeded for that waterbody during the five-year data window and subsequent monitoring of five times within 30 days exceeded the 200 colonies per 100 ml geomean, or greater than 20 percent of these samples exceeded 400 colonies per 100 ml over the five-year data window. These waters are rated Supporting for secondary recreation if neither portion of the state standard is exceeded. Waters without sufficient fecal coliform data or swimming advisories are Not Rated and waters with no data are noted as having No Data.

DWQ attempts to determine if there are any inland swimming areas monitored by county or local health departments or estuarine (Class SA and SB) waters as assessed by DEH. Each January, DEH, county or local health departments are asked to list those waters which were posted with swimming advisories in the previous year. When reviewing DEH fecal coliform data and local swimming advisories, the same five-year window that ends on August 31 of the year of biological sampling is used. If a water was posted with a swimming advisory for at least two months within the five-year data window, it is further evaluated for the persistence of elevated fecal coliform bacteria levels. Those waters posted with swimming advisories for more than two months in the five-year data window are rated Impaired unless county or state health agencies believe that the cause of the swimming advisory is not persistent. If DEH has no data on an estuarine water, that water will not be rated for recreational uses.

### **Shellfish Harvesting Use Support**

The shellfish harvesting use support category is a human health approach to assess whether shellfish can be commercially harvested and is therefore applied only to Class SA waters. The following data sources are used to determine use support ratings for shellfish waters and to determine causes and sources of impairment for these waters.

#### **Division of Environmental Health (DEH) Shellfish Sanitation Surveys**

DEH is required to classify all shellfish growing areas as to their suitability for shellfish harvesting. Estuarine waters are delineated according to DEH shellfish management areas (e.g., Outer Banks, Area H-5) which include Class SA, SB and SC waters. DEH samples growing areas regularly and reevaluates the areas by conducting shellfish sanitation surveys every three years to determine if their classification is still applicable. DEH classifications may be changed after the most recent sanitary survey. Classifications are based on DEH fecal coliform bacteria sampling, locations of pollution sources, and the availability of the shellfish resource. Growing waters are classified as follows:

DEH Classification	DEH Criteria
Approved (APP)	<p><b>Fecal Coliform Standard for Systematic Random Sampling:</b> The median fecal coliform Most Probable Number (MPN) or the geometric mean MPN of the water shall not exceed 14 per 100 milliliters (ml), and the estimated 90<sup>th</sup> percentile shall not exceed an MPN of 43 MPN per 100 ml for a 5-tube decimal dilution test.</p> <p><b>Fecal Coliform Standard for Adverse Pollution Conditions Sampling:</b> The median fecal coliform or geometric mean MPN of the water shall not exceed 14 per 100 ml, and not more than 10 percent of the samples shall exceed 43 MPN per 100 ml for a 5-tube decimal dilution test.</p>
Conditionally Approved-Open (CAO)	Sanitary Survey indicates an area can meet approved area criteria for a reasonable period of time, and the pollutant event is known and predictable and can be managed by a plan. These areas tend to be open more frequently than closed.
Conditionally Approved-Closed (CAC)	Sanitary Survey indicates an area can meet approved area criteria for a reasonable period of time, and the pollutant event is known and predictable and can be managed by a plan. These areas tend to be closed more frequently than open.
Restricted (RES)	Sanitary Survey indicates limited degree of pollution, and the area is not contaminated to the extent that consumption of shellfish could be hazardous after controlled depuration or relaying.
Prohibited (PRO)	No Sanitary Survey; point source discharges; marinas; data do not meet criteria for Approved, Conditionally Approved or Restricted Classification.

#### Assigning Use Support Ratings to Shellfish Harvesting Waters (Class SA)

It is important to note that DEH classifies all actual and potential growing areas (which includes all saltwater and brackish water areas) for their suitability for shellfish harvesting. Thus, the DWQ Class SA waters must be separated out and rated for shellfish harvesting use support. The acreage of Supporting and Impaired waters are calculated using GIS showing DWQ and DEH classifications as attribute information. However, the DEH "Closed" polygon coverage includes CAC, RES and PRO classifications, and it is not currently possible to separate out the PRO from the RES areas. Therefore, these areas are a combined polygon coverage, and DWQ rates these waters as Impaired.

DWQ use support ratings may be assigned to separate segments within DEH management areas. In assessing use support, the DEH classifications and management strategies are only applicable to those areas that DWQ Class SA (shellfish harvesting waters). This will result in a difference of acreage between DEH areas classified as CAC, PRO, RES and DWQ waters rated as Impaired. For example, if DEH classifies a 20-acre area CAC, but only ten acres are Class SA, only those ten acres of Class SA waters are rated as Impaired.

Sources of fecal coliform bacteria are more difficult to separate out for Class SA areas. DEH describes the potential sources in the sanitary surveys, but they do not describe specific areas affected by these sources. Therefore, in the past, DEH identified the same sources for all Class SA sections of an entire management area (e.g., urban runoff and septic systems). Until a better way to pinpoint sources is developed, this procedure will continue to be used. A point source discharge is only listed as a potential source when NPDES permit limits are exceeded.

DWQ and DEH are developing the database and expertise necessary to assess shellfish harvesting use support using a frequency of closures-based approach. This database will allow DWQ to better assess the extent and duration of closures in Class SA waters. These tools will not be available for use support determinations in Class SA waters for the 2001 White Oak, 2002 Neuse and 2003 Lumber River basin use support assessments. DWQ believes it is important to identify frequency of closures in these waters, so an interim methodology will be used based on existing databases and GIS shapefiles. There will likely be changes in reported acreages in future assessments using the permanent methods and tools that result from this project. DWQ and DEH hope to have these tools fully developed for using the frequency of closure-based methods for the 2005 Cape Fear River use support assessment and basin plan.

### **Interim Frequency of Closure-Based Assessment Methodology**

The interim method will be used for the 2001 White Oak, 2002 Neuse and 2003 Lumber River basin use support assessments. Shellfish harvesting use support ratings for Class SA waters using the interim methodology are summarized below.

#### **Interim Frequency of Closure-Based Use Support Ratings**

<b>Percent of Time Closed within Basin Data Window</b>	<b>DEH Growing Area Classification</b>	<b>DWQ Use Support Rating</b>
N/A	Approved*	Supporting
Closed ≤10% of data window	Portion of CAO closed ≤10% of data window	Supporting
Closed >10% of the data window	Portion of CAO closed >10% of data window	Impaired
N/A	CAC and P/R**	Impaired

\* Approved waters are closed only during extreme meteorological events (hurricanes).

\*\* CAC and P/R waters are rarely opened to shellfish harvesting.

For CAO areas, DWQ will work with DEH to determine the number of days and acreages that CAO Class SA waters were closed to shellfish harvesting during a five-year window of data that ends on August 31 of the year of biological sampling. For example, if biological data are collected in a basin in 2000, then the five-year window for data review would be September 1, 1995 to August 31, 2000. For each growing area with CAO Class SA waters, DEH and DWQ staff will define subareas within the CAO area that were opened and closed at the same time. The number of days these CAO areas were closed will be determined using DEH proclamation summary sheets and the original proclamations.

The number of days that APP areas in the growing area were closed due to preemptive closures because of named storms is not counted. For example, all waters in growing area E-9 were preemptively closed for Hurricane Fran on September 5, 1996. APP waters were reopened September 20, 1996. Nelson Bay (CAO) was reopened September 30, 1996. This area was considered closed for ten days after the APP waters were reopened.

## **Proposed Permanent Frequency of Closure-Based Assessment Methodology**

Over the next few years DWQ, DEH, Division of Coastal Management (DCM) and Division of Marine Fisheries (DMF) will be engaged in developing a fully functionally database with related georeferenced (GIS) shellfish harvesting areas. The new database and GIS tools will be valuable for the above agencies to continue to work together to better serve the public. DWQ proposes to use information generated by these new tools to do frequency of closure-based shellfish harvesting use support assessments in Class SA waters, starting with the 2005 Cape Fear River basin use support assessment.

Using the new database with georeferenced areas and monitoring sites, DEH will be able to report the number of days each area was closed excluding closures related to named storms. The percent of the five-year data window that individual Class SA waters are closed will be used to make use support determinations for areas that are classified by DEH as CAO. PRO, RES and CAC areas will be rated Impaired, and CAO areas will be rated Supporting or Impaired based on the methodology outlined above in the interim methods. Growing areas that have been reclassified by DEH during the data window from a lower classification to APP will be rated FS. Areas that are reclassified from APP to CAO during the data window will be rated as described above in the interim methods, taking into account the total days closed during the data window, including when the area was classified as APP.

## **Water Supply Use Support**

This use support category is used to assess all Class WS waters and is a human health approach to assess whether a water can be used for water supply purposes. Many drinking water supplies in NC are drawn from human-made reservoirs that often have multiple uses.

Water supply use support is assessed using information from the seven regional water treatment plant (WTP) consultants. Each January, the WTP consultants submit a spreadsheet listing closures and water intake switch-overs for all water treatment plants in their region. This spreadsheet describes the length and time of the event, contact information for the WTP, and the reason for the closure or switch.

The WTP consultants' spreadsheets are reviewed to determine if any closures/switches were due to water quality concerns. Those closures/switches due to water quantity problems and reservoir turnovers are not considered for use support. The frequency and duration of closures/switches due to water quality concerns are considered when assessing use support. In general, North Carolina's surface water supplies are currently rated Supporting. Specific criteria for rating waters Impaired are yet to be determined.

## **Other Uses: All Waters in the State**

This category of use will be assessed infrequently but could be applied to any water in the state. Examples of uses that could fall into this category are aesthetics and industrial and agricultural water supply. This category allows for the assessment of any use that is not considered for aquatic life, primary/secondary recreation, fish consumption, shellfish harvesting or water supply.

## D. Use of Outside Data

DWQ actively solicits outside data and information in the year before biological sampling in a particular basin. The solicitation allows approximately 60 days for data to be submitted. Data from sources outside DWQ are screened for data quality and quantity. If data are of sufficient quality and quantity, they may be incorporated into use support assessments. A minimum of ten samples for more than a one-year period is needed to be considered for use support assessments.

The way the solicited data are used depends on the degree of quality assurance and quality control of the collection and analysis of the data as detailed in the 303(d) report and shown in the table below. Level 1 data can be used with the same confidence as DWQ data to determine use support ratings. Level 2 or Level 3 data may be used to help identify causes of pollution and problem parameters. They may also be used to limit the extrapolation of use support ratings up or down a stream segment from a DWQ monitoring location. Where outside data indicate a potential problem, DWQ evaluates the existing DWQ biological and ambient monitoring site locations for adjustment as appropriate.

Criteria Levels for Use of Outside Data in Use Support Assessments			
Criteria	Level 1	Level 2	Level 3
Monitoring frequency of at least 10 samples for more than a one-year period	Yes	Yes/No	No
Monitoring locations appropriately sited and mapped	Yes	Yes	No
State certified laboratory used for analysis according to 15A NCAC 2B .0103	Yes	Yes/No	No
Quality assurance plan available describing sample collection and handling	Yes, rigorous scrutiny	Yes/No	No

## F. Nutrient Enrichment Issues

One of the main causes of impacts to lakes is nutrient enrichment, or eutrophication. Several water quality variables help to describe the level of eutrophication. These include pH, chlorophyll *a*, dissolved oxygen, phosphorus, nitrogen, turbidity, total dissolved gases and other quantitative indicators, some of which have specific water quality standards. It is generally agreed that excessive amounts of nitrogen and phosphorus are the principal culprits in eutrophication related use impairment. These variables are important concerns; however, climate, hydrology and biological response factors (chlorophyll, phytoplankton, fish kills, etc.) are also essential to evaluate because they may control the frequency of episodes related to potential use impairment. In addition, many of North Carolina's lakes are human-made reservoirs that do not mimic natural systems.

Violations of water quality standards in lakes or estuaries are not equated with use impairment unless uses are not met. DWQ does not determine eutrophication related use impairment with the quantitative assessment of an individual water quality variable (i.e., chlorophyll *a*). Likewise, DWQ does not depend on a fixed index composed of several water quality variables,



which does not have the flexibility to adapt to numerous hydrological situations, to determine use impairment. Instead, the weight of evidence approach is used to determine use support in lakes. This approach can be flexibly applied depending on the amount and quality of available information. The approach uses the following sources of information:

- Multiple quantitative water quality variables (e.g., dissolved oxygen, chlorophyll *a*)
- Third party reports
- Analysis of water quality or aesthetic complaints, and taste and odor observations
- Algal bloom reports
- Macrophyte observations
- Fish kill reports
- Frequency of noxious algal activity
- Reports/observations of the NC Wildlife Resources Commission, lake associations and water treatment plant operators

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## Lumber River Basin Use Support

## Aquatic Life

December 2003

Name	Assessment Unit Number	Description	Class	Subbasin	Stream Miles	Fresh water Acres	Estuarine Acres	Coastline Miles	Rating	Basis	Source	Problem Parameter(s)	Potential Sources
Drowning Creek	14-2-(1)a	From source to Jackson Creek	WS-II Sw	03-07-50	14.0	0.0	0.0	0.0	NR	M			
Drowning Creek	14-2-(1)b	From Jackson Creek to Naked Creek	WS-II Sw	03-07-50	7.5	0.0	0.0	0.0	S	ME			
Drowning Creek	14-2-(10.5)	From a point 0.4 mile upstream of US Hwy 1 to Lumber River	C Sw HQW	03-07-50	15.7	0.0	0.0	0.0	S	M			
Drowning Creek	14-2-(6.5)	From Naked Creek to Horse Creek	WS-II Sw	03-07-50	6.3	0.0	0.0	0.0	S	M			
Drowning Creek	14-2-(9)	From Horse Creek to a point 0.4 mile upstream of US Hwy 1 (Town of Southern Pines water supply intake)	WS-II Sw CA	03-07-50	0.6	0.0	0.0	0.0	S	ME			
Buffalo Creek	14-2.5	From source to Lumber River	C	03-07-50	6.3	0.0	0.0	0.0	NR	M			
Deep Creek	14-2-10-1-(2)	From a point 3,500 feet upstream from Moore County SR 1122 to Horse Creek	WS-II	03-07-50	8.2	0.0	0.0	0.0	NR	M			
Horse Creek (Pinehurst Lake)	14-2-10b	From SR 1115 to Drowning Creek	WS-II	03-07-50	7.5	0.0	0.0	0.0	S	M			
Aberdeen Creek [Pages Lake (Aberdeen Lake)]	14-2-11-(5)	From backwaters of Pages Lake (Aberdeen Lake) at normal lake elevation to dam of Pages Lake (Aberdeen Lake)	B	03-07-50	0.0	35.2	0.0	0.0	S	M			
Aberdeen Creek	14-2-11-(6)	From dam at Pages Lake (Aberdeen Lake) to Drowning Creek	C	03-07-50	7.3	0.0	0.0	0.0	NR	M			
Quewhiffle Creek	14-2-14	From source to Drowning Creek	C	03-07-50	9.0	0.0	0.0	0.0	NR	M			
Mountain Creek	14-2-16-(2)	From dam at Mountain Lake to Drowning Creek	C	03-07-50	6.0	0.0	0.0	0.0	NR	M			
Jackson Creek (Curries Pond)	14-2-5	From source to Drowning Creek	WS-II	03-07-50	8.7	0.0	0.0	0.0	S	M			
Naked Creek	14-2-6	From source to Drowning Creek	WS-II ORW	03-07-50	15.7	0.0	0.0	0.0	S	M			
Lumber River	14-(1)	From source (junction of Buffalo Creek and Drowning Creek) to a point 2.0 miles upstream of US Hwy 401	WS-V Sw HQW	03-07-51	4.8	0.0	0.0	0.0	S	ME			
Lumber River	14-(10.3)	From a point 0.5 mile upstream of Powell Branch to Raw Water Supply Intake for City of Lumberton	WS-IV Sw HQW CA	03-07-51	0.6	0.0	0.0	0.0	S	ME			

## Lumber River Basin Use Support

## Aquatic Life

December 2003

Name	Assessment Unit Number	Description	Class	Subbasin	Stream Miles	Fresh water Acres	Estuarine Acres	Coastline Miles	Rating	Basis	Source	Problem Parameter(s)	Potential Sources
Lumber River	14-(11)	From Raw Water Supply Intake for City of Lumberton to US Hwy 301 Bypass	B Sw HQW	03-07-51	0.5	0.0	0.0	0.0	S	ME			
Lumber River	14-(13)a	From US Hwy 301 Bypass to SR 2289, Robeson County	C Sw	03-07-51	3.9	0.0	0.0	0.0	S	M			
Lumber River	14-(13)b	From SR 2289, Robeson County to Lumber River above Alpha Cellulose SR 2202	C Sw	03-07-51	1.1	0.0	0.0	0.0	S	ME			
Lumber River	14-(13)c	From above Alpha Cellulose SR 2202 to WWTP at Robeson County	C Sw	03-07-51	0.4	0.0	0.0	0.0	S	ME			
Lumber River	14-(13)d	From WWTP at Robeson County to below WWTP at SR 1620/72 Robeson County	C Sw	03-07-51	1.4	0.0	0.0	0.0	S	M			
Lumber River	14-(13)e	From below WWTP at SR 1620/72 Robeson County to NC 74 Robeson County	C Sw	03-07-51	21.5	0.0	0.0	0.0	S	M			
Lumber River	14-(13)f	From NC 74 Robeson County to NC 904	C Sw	03-07-51	23.0	0.0	0.0	0.0	S	M			
Lumber River	14-(28)	From NC Hwy 904 to North Carolina-South Carolina State Line	B Sw	03-07-51	4.0	0.0	0.0	0.0	S	ME			
Lumber River	14-(3)a	From a point 2.0 miles upstream of US Hwy 401 to SR 1404, Scotland Co.	WS-IV&B Sw HQW	03-07-51	4.5	0.0	0.0	0.0	S	M			
Lumber River	14-(3)b	From SR 1404 to a point 1.1 miles upstream of NC Hwy 71	WS-IV&B Sw HQW	03-07-51	12.5	0.0	0.0	0.0	S	ME			
Lumber River	14-(4)	From a point 1.1 miles upstream of NC Hwy 71 to Robeson County Water Supply Intake (located 0.5 mile upstream of NC Hwy 71)	WS-IV&B Sw HQW CA	03-07-51	0.7	0.0	0.0	0.0	S	M			
Lumber River	14-(4.5)a	From Robeson County Water Supply Intake (located 0.5 mile upstream of NC Hwy 71) to NC 71	B Sw HQW	03-07-51	0.6	0.0	0.0	0.0	S	M			
Lumber River	14-(4.5)b	From NC 71 to SR 1303	B Sw HQW	03-07-51	3.3	0.0	0.0	0.0	S	M			
Lumber River	14-(4.5)c	From SR 1303 to SR 1153 Robeson County	B Sw HQW	03-07-51	3.1	0.0	0.0	0.0	S	ME			

## Lumber River Basin Use Support

## Aquatic Life

December 2003

Name	Assessment Unit Number	Description	Class	Subbasin	Stream Miles	Fresh water Acres	Estuarine Acres	Coastline Miles	Rating	Basis	Source	Problem Parameter(s)	Potential Sources
Lumber River	14-(4.5)d	From SR 1153 Robeson County to Seaboard Coast Line Railroad bridge near Pembroke	B Sw HQW	03-07-51	15.3	0.0	0.0	0.0	S	ME			
Lumber River	14-(7)	From Seaboard Coast Line Railroad bridge near Pembroke to a point 0.5 mile upstream of Powell Branch	WS-IV&B Sw HQW	03-07-51	22.7	0.0	0.0	0.0	S	M			
Porter Swamp	14-27	From source to Lumber River	C Sw	03-07-51	21.5	0.0	0.0	0.0	NR	M			
Gapway Swamp (Buffkin Pond, Richardson Pond)	14-31	From source to North Carolina-South Carolina State Line	C Sw	03-07-51	6.6	0.0	0.0	0.0	NR	M			
Gum Swamp	14-5	From source to Lumber River	C	03-07-51	13.0	0.0	0.0	0.0	S	M			
Back Swamp	14-8-(2.5)	From Roberson County SR 1157 to Lumber River	WS-IV Sw	03-07-51	7.5	0.0	0.0	0.0	NR	M			
Bear Swamp	14-9-(1.5)	From Robeson County SR 1515 to Lumber River	WS-IV Sw	03-07-51	9.5	0.0	0.0	0.0	NR	M			
Raft Swamp	14-10-(1)	From source to Robeson County SR 1318	C Sw	03-07-52	22.9	0.0	0.0	0.0	S	M			
Raft Swamp	14-10-(5.5)	From Robeson County SR 1318 to Lumber River	WS-IV Sw	03-07-52	14.1	0.0	0.0	0.0	S	M			
Little Raft Swamp	14-10-5	From source to Raft Swamp	C Sw	03-07-52	19.9	0.0	0.0	0.0	NR	M			
Little Marsh Swamp	14-22-1-3	From source to Gallberry Swamp	C Sw	03-07-53	19.9	0.0	0.0	0.0	NR	M			
Big Marsh Swamp (Marsh Swamp) (Lake McNeill, Odom Pond)	14-22-2	From source to Big Swamp	C Sw	03-07-53	28.0	0.0	0.0	0.0	NR	M			
Big Swamp	14-22a	From source to NC 211	C Sw	03-07-53	15.4	0.0	0.0	0.0	S	M			
Hog Swamp	14-30-7	From source to Ashpole Swamp	C Sw	03-07-54	4.9	0.0	0.0	0.0	NR	M			
Ashpole Swamp	14-30a	From source to Hog Swamp	C Sw	03-07-54	18.8	0.0	0.0	0.0	S	ME			
Ashpole Swamp	14-30b	From Hog Swamp to North Carolina-South Carolina State Line	C Sw	03-07-54	6.9	0.0	0.0	0.0	S	M			

## Lumber River Basin Use Support

## Aquatic Life

December 2003

Name	Assessment Unit Number	Description	Class	Subbasin	Stream Miles	Fresh water Acres	Estuarine Acres	Coastline Miles	Rating	Basis	Source	Problem Parameter(s)	Potential Sources
Gum Swamp Creek (Pine Lake, Gum Swamp Lake)	14-32-(1)	From source to Crawford Branch	C	03-07-55	8.0	0.0	0.0	0.0	S	ME			
Gum Swamp Creek (Ida Mill Pond)	14-32-(10)	From dam at Richmond Mill Lake to US Hwy 74	C Sw	03-07-55	1.4	0.0	0.0	0.0	S	ME			
Gum Swamp Creek (Lychts Pond)	14-32-(12)	From US Hwy 74 to North Carolina-South Carolina State Line	B Sw	03-07-55	14.1	0.0	0.0	0.0	S	M			
Gum Swamp Creek (Richmond Mill Lake)	14-32-(7)	From Crawford Branch to dam at Richmond Mill Lake	B	03-07-55	5.8	0.0	0.0	0.0	S	M			
Joes Creek (Guinns Mill Pond)	14-32-14	From source to Gum Swamp Creek	C Sw	03-07-55	15.8	0.0	0.0	0.0	NR	M			
Leith Creek (Johns Pond)	14-33a	From source to Bridge Creek	C Sw	03-07-55	16.4	0.0	0.0	0.0	S	M			
Leith Creek (Johns Pond)	14-33b	From Bridge Creek to North Carolina-South Carolina State Line	C Sw	03-07-55	5.1	0.0	0.0	0.0	S	M			
Shoe Heel Creek (Big Shoe Heel Creek) (Maxton Pond)	14-34	From source to North Carolina-South Carolina State Line	C Sw	03-07-55	35.7	0.0	0.0	0.0	S	M			
Jordan Creek [Monroe Mill Pond (Lake Andrews)]	14-34-4-(1)	From source to dam at Monroe Mill	B Sw	03-07-55	8.6	0.0	0.0	0.0	S	ME			
Jordan Creek	14-34-4-(2)	From dam at Monroe Mill Pond to Shoe Heel Creek	C Sw	03-07-55	11.4	0.0	0.0	0.0	S	M			
Juniper Creek (McNair Pond)	14-34-4-3	From source to Jordan Creek	C Sw	03-07-55	12.8	0.0	0.0	0.0	NR	M			
Waccamaw River	15-(1)a	From source at dam at Lake Waccamaw to 0.1 mi below Lake Waccamaw	C Sw	03-07-56	0.2	0.0	0.0	0.0	S	ME			

## Lumber River Basin Use Support

## Aquatic Life

December 2003

Name	Assessment Unit Number	Description	Class	Subbasin	Stream Miles	Fresh water Acres	Estuarine Acres	Coastline Miles	Rating	Basis	Source	Problem Parameter(s)	Potential Sources
Waccamaw River	15-(1)b	From 0.1 mi below dam at Lake Waccamsw to off SR 1930	C Sw	03-07-56	6.8	0.0	0.0	0.0	S	ME			
Waccamaw River	15-(1)c	From site off SR 1930 to SR 1928	C Sw	03-07-56	3.5	0.0	0.0	0.0	S	M			
Lake Waccamaw	15-2	Entire Lake	B Sw	03-07-56	0.0	8840.2	0.0	0.0	S	M			
Fryer Swamp (Council Millpond)	15-2-6-3	From source to Big Creek	C Sw	03-07-56	11.6	0.0	0.0	0.0	NR	M			
Waccamaw River	15-(1)d	From SR 1928 to NC 130	C Sw	03-07-57	8.9	0.0	0.0	0.0	S	M			
Waccamaw River	15-(1)e	From NC 130 to NC 904	C Sw	03-07-57	18.1	0.0	0.0	0.0	S	M			
Waccamaw River	15-(18)	From NC Hwy 904 to North Carolina-South Carolina State Line	B Sw	03-07-57	9.9	0.0	0.0	0.0	S	M			
Seven Creeks (Joe Lake)	15-17	From source to Waccamaw River	C Sw	03-07-57	4.3	0.0	0.0	0.0	S	M			
Grissett Swamp	15-17-1-(5)	From dam at Lake Tabor to Seven Creeks	C Sw	03-07-57	20.8	0.0	0.0	0.0	NR	M			
Cawcaw Swamp	15-23	From source to Waccamaw River	C Sw	03-07-57	12.4	0.0	0.0	0.0	NR	M	NP		
Elkton Marsh	15-4-1-1-2	From source to Brown Marsh	C Sw	03-07-58	5.4	0.0	0.0	0.0	NR	M			
White Marsh	15-4b	From Richardson Swamp to Waccamaw River	C Sw	03-07-58	12.6	0.0	0.0	0.0	NR	M			
Lockwoods Folly River	15-25-1-(11)	From mouth of Royal Oak Swamp to Brunswick County SR 1200	SC HQW	03-07-59	10.3	0.0	0.0	0.0	S	M			
Lockwoods Folly River	15-25-1-(16)a	From Brunswick County, SR 1200 to a line crossing Lockwood Folley River 520 meters north of Myrle Point of the east shore to a point of the west shore 704 meters north of Mullet Creek.	SA	03-07-59	0.0	0.0	123.6	0.0	S	M			

## Lumber River Basin Use Support

## Aquatic Life

December 2003

Name	Assessment Unit Number	Description	Class	Subbasin	Stream Miles	Fresh water Acres	Estuarine Acres	Coastline Miles	Rating	Basis	Source	Problem Parameter(s)	Potential Sources
Lockwoods Folly River	15-25-1-(16)b	From a line crossing Lockwood Folley River 520 meters north of Myrtle Point of the east shore to a point of the west shore 704 meters north of Mullet Creek to a line crossing Lockwood Folly River 146 meters north of Genoes Point on the east shore to a point on the west shore 777 meters south of Mullet Creek.	SA	03-07-59	0.0	0.0	275.6	0.0	S	M			
Lockwoods Folly River	15-25-1-(16)c	From a line crossing Lockwood Folly River 146 meters north of Genoes Point on the east shore to a point on the west shore 777 meters south of Mullet Creek to a line crossing Lockwood Folly River 628 meters south of Genoes Point on the east shore to Gores Landing on the east shore.	SA	03-07-59	0.0	0.0	207.0	0.0	S	ME			
Lockwoods Folly River	15-25-1-(16)d	From a line crossing Lockwood Folly River 628 meters south of Genoes Point on the east shore to Gores Landing on the east shore to ICWW.	SA	03-07-59	0.0	0.0	53.1	0.0	S	M			
Royal Oak Swamp	15-25-1-12a	From source to NC 211	C Sw	03-07-59	5.9	0.0	0.0	0.0	NR	M			
Shallotte River	15-25-2-(1)	From source to NC Hwy 130	C Sw HQW	03-07-59	9.5	0.0	0.0	0.0	S	M			
Shallotte River	15-25-2-(10)c	From a line crossing the Shallotte River 459 meters north of Shell Point on the east bank across to a point 651 meters north of the Swash to a line crossing the Shallotte River from Shell Point across to the Swash.	SA	03-07-59	0.0	0.0	89.0	0.0	S	ME			
Shallotte River	15-25-2-(10)d	From a line crossing the Shallotte River from Shell Point across to the Swash to the Intracoastal Waterway.	SA	03-07-59	0.0	0.0	340.6	0.0	S	M			
Calabash River	15-25-5	From source to North Carolina-South Carolina State Line	SA	03-07-59	0.0	0.0	3.4	0.0	S	M	NP		



Name	Assessment Unit Number	Description	Class	Subbasin	Stream Miles	Fresh water Acres	Estuarine Acres	Coastline Miles	Rating	Basis	Source	Problem Parameter(s)	Potential Sources
Intracoastal Waterway	15-25d	From Cape Fear River Basin at Buoy FI R ev. 4 sec "22" to North Carolina-South Carolina State Line, including all sloughs, sounds, inlets and connecting channels	SA	03-07-59	0.0	0.0	315.6	0.0	S	M	NP		
Intracoastal Waterway	15-25i	From Cape Fear River Basin at Buoy FI R ev. 4 sec "22" to North Carolina-South Carolina State Line, including all sloughs, sounds, inlets and connecting channels	SA	03-07-59	0.0	0.0	65.8	0.0	S	M	NP		
Intracoastal Waterway	15-25t	From Cape Fear River Basin at Buoy FI R ev. 4 sec "22" to North Carolina-South Carolina State Line, including all sloughs, sounds, inlets and connecting channels	SA	03-07-59	0.0	0.0	292.8	0.0	S	M	NP		
Intracoastal Waterway	15-25u	From Cape Fear River Basin at Buoy FI R ev. 4 sec "22" to North Carolina-South Carolina State Line, including all sloughs, sounds, inlets and connecting channels	SA	03-07-59	0.0	0.0	403.5	0.0	S	M	NP		
Montgomery Slough	15-25v	From Cape Fear River Basin at Buoy FI R ev. 4 sec "22" to North Carolina-South Carolina State Line, including all sloughs, sounds, inlets and connecting channels	SA	03-07-59	2.3	0.0	0.0	0.0	S	M			

**NOTES**

"Rating" = Use Support Rating

"Basis" = Rating basis

"Habitat degradation" is identified where there is a notable reduction in habitat diversity or change in habitat quality. This term includes sedimentation, bank erosion, channelization, lack of riparian vegetation, loss of pools or riffles, loss of woody habitat, and streambed scour.

**ABBREVIATION KEY**

P = Point Source Pollution (Major source)

NP = Nonpoint Source Pollution

M = Monitored

S = Supporting

I = Impaired

NR = Not Rated

## Lumber River Basin Use Support

## Recreation

December 2003

Name	Assessment Unit Number	Subbasin	Description	Class	Stream Miles	Fresh Water Acres	Estaurine Acres	Coastline Miles	Rating	Basis
Drowning Creek	14-2-(10.5)	03-07-50	From a point 0.4 mile upstream of US Hwy 1 to Lumber River	C Sw HQW	15.7	0.0	0.0	0.0	S	M
Lumber River	14-(13)e	03-07-51	From below WWTP at SR 1620/72 Robeson County to NC 74 Robeson County	C Sw	21.5	0.0	0.0	0.0	S	M
Lumber River	14-(13)f	03-07-51	From NC 74 Robeson County to NC 904	C Sw	23.0	0.0	0.0	0.0	S	M
Lumber River	14-(3)a	03-07-51	From a point 2.0 miles upstream of US Hwy 401 to SR 1404, Scotland Co.	WS-IV&B Sw HQW	4.5	0.0	0.0	0.0	S	M
Lumber River	14-(4.5)a	03-07-51	From Robeson County Water Supply Intake (located 0.5 mile upstream of NC Hwy 71) to NC 71	B Sw HQW	0.6	0.0	0.0	0.0	S	M
Lumber River	14-(4.5)b	03-07-51	From NC 71 to SR 1303	B Sw HQW	3.3	0.0	0.0	0.0	S	M
Lumber River	14-(7)	03-07-51	From Seaboard Coast Line Railroad bridge near Pembroke to a point 0.5 mile upstream of Powell Branch	WS-IV&B Sw HQW	22.7	0.0	0.0	0.0	S	M
Raft Swamp	14-10-(1)	03-07-52	From source to Robeson County SR 1318	C Sw	22.9	0.0	0.0	0.0	S	M
Raft Swamp	14-10-(5.5)	03-07-52	From Robeson County SR 1318 to Lumber River	WS-IV Sw	14.1	0.0	0.0	0.0	S	M
Big Swamp	14-22a	03-07-53	From source to NC 211	C Sw	15.4	0.0	0.0	0.0	S	M
Ashpole Swamp	14-30b	03-07-54	From Hog Swamp to North Carolina-South Carolina State Line	C Sw	6.9	0.0	0.0	0.0	S	M
Leith Creek (Johns Pond)	14-33a	03-07-55	From source to Bridge Creek	C Sw	16.4	0.0	0.0	0.0	S	M
Leith Creek (Johns Pond)	14-33b	03-07-55	From Bridge Creek to North Carolina-South Carolina State Line	C Sw	5.1	0.0	0.0	0.0	NR	M
Shoe Heel Creek (Big Shoe Heel Creek) (Maxton Pond)	14-34	03-07-55	From source to North Carolina-South Carolina State Line	C Sw	35.7	0.0	0.0	0.0	S	M
Lake Waccamaw	15-2	03-07-56	Entire Lake	B Sw	0.0	8840.2	0.0	0.0	S	M
Waccamaw River	15-(1)e	03-07-57	From NC 130 to NC 904	C Sw	18.1	0.0	0.0	0.0	S	M
Waccamaw River	15-(18)	03-07-57	From NC Hwy 904 to North Carolina-South Carolina State Line	B Sw	9.9	0.0	0.0	0.0	S	M
Seven Creeks (Joe Lake)	15-17	03-07-57	From source to Waccamaw River	C Sw	4.3	0.0	0.0	0.0	S	M
Lockwoods Folly River	15-25-1-(11)	03-07-59	From mouth of Royal Oak Swamp to Brunswick County SR 1200	SC HQW	10.3	0.0	0.0	0.0	S	M

## Lumber River Basin Use Support

## Recreation

December 2003

Name	Assessment Unit Number	Subbasin	Description	Class	Stream Miles	Fresh Water Acres	Estaurine Acres	Coastline Miles	Rating	Basis
Lockwoods Folly River	15-25-1-(16)a	03-07-59	From Brunswick County, SR 1200 to a line crossing Lockwood Folley River 520 meters north of Myrle Point of the east shore to a point of the west shore 704 meters north of Mullet Creek.	SA	0.0	0.0	123.6	0.0	S	M
Lockwoods Folly River	15-25-1-(16)b	03-07-59	From a line crossing Lockwood Folley River 520 meters north of Myrtle Point of the east shore to a point of the west shore 704 meters north of Mullet Creek to a line crossing Lockwood Folly River 146 meters north of Genoes Point on the east shore to a point on the west shore 777 meters south of Mullet Creek.	SA	0.0	0.0	275.6	0.0	S	M
Lockwoods Folly River	15-25-1-(16)d	03-07-59	From a line crossing Lockwood Folly River 628 meters south of Genoes Point on the east shore to Gores Landing on the east shore to ICWW.	SA	0.0	0.0	53.1	0.0	S	M
Shallotte River	15-25-2-(1)	03-07-59	From source to NC Hwy 130	C Sw HQW	9.5	0.0	0.0	0.0	S	M
Shallotte River	15-25-2-(10)d	03-07-59	From a line crossing the Shallotte River from Shell Point across to the Swash to the Intracoastal Waterway.	SA	0.0	0.0	340.6	0.0	S	M
Calabash River	15-25-5	03-07-59	From source to North Carolina-South Carolina State Line	SA	0.0	0.0	3.4	0.0	S	M
Intracoastal Waterway	15-25d	03-07-59	From Cape Fear River Basin at Buoy FI R ev. 4 sec "22" to North Carolina-South Carolina State Line, including all sloughs, sounds, inlets and connecting channels	SA	0.0	0.0	315.6	0.0	S	M
Intracoastal Waterway	15-25i	03-07-59	From Cape Fear River Basin at Buoy FI R ev. 4 sec "22" to North Carolina-South Carolina State Line, including all sloughs, sounds, inlets and connecting channels	SA	0.0	0.0	65.8	0.0	S	M
Intracoastal Waterway	15-25j	03-07-59	From Cape Fear River Basin at Buoy FI R ev. 4 sec "22" to North Carolina-South Carolina State Line, including all sloughs, sounds, inlets and connecting channels	SA	0.0	0.0	165.2	0.0	S	M
Intracoastal Waterway	15-25t	03-07-59	From Cape Fear River Basin at Buoy FI R ev. 4 sec "22" to North Carolina-South Carolina State Line, including all sloughs, sounds, inlets and connecting channels	SA	0.0	0.0	292.8	0.0	S	M
Intracoastal Waterway	15-25u	03-07-59	From Cape Fear River Basin at Buoy FI R ev. 4 sec "22" to North Carolina-South Carolina State Line, including all sloughs, sounds, inlets and connecting channels	SA	0.0	0.0	403.5	0.0	S	M
Montgomery Slough	15-25v	03-07-59	From Cape Fear River Basin at Buoy FI R ev. 4 sec "22" to North Carolina-South Carolina State Line, including all sloughs, sounds, inlets and connecting channels	SA	2.3	0.0	0.0	0.0	S	M

Name	Assessment Unit Number	Subbasin	Description	Class	Stream Miles	Fresh Water Acres	Estaurine Acres	Coastline Miles	Rating	Basis
Atlantic Ocean	99-(1)	03-07-59	The waters of the Atlantic Ocean contiguous to that portion of the Waccamaw River Drainage Area of the Lumber River Basin extending from the Cape Fear River Basin to the North Carolina South Carolina State Line	SB	0.0	0.0	0.0	25.6	S	M
<b>NOTES</b>										
"Rating" = Use Support Rating										
"Basis" = Rating basis										
<b>ABBREVIATION KEY</b>										
M = Monitored										
S = Supporting										
I = Impaired										
NR = Not Rated										

Name	Assessment Unit Number	Description	Class	Subbasin	Stream Miles	Estuarine Acres	Coastline Miles	Rating	Basis	DEH Class	Percent Closed
Big Gut Slough	15-25-3	From source to Intracoastal Waterway	SA	03-07-59	0.0	0.3	0.0	I	M	PRO	100
Calabash River	15-25-5	From source to North Carolina-South Carolina State Line	SA	03-07-59	0.0	3.4	0.0	I	M	PRO	100
Goose Creek	15-25-2-16-4-(2)	From Brunswick County SR 1143 to Saucepan Creek	SA	03-07-59	0.0	4.2	0.0	I	M	PRO	100
Hangman Branch	15-25-5-1	From source to Calabash Creek	SA	03-07-59	0.0	10.2	0.0	I	M	PRO	100
Intracoastal Waterway	15-25a	From Cape Fear River Basin at Buoy FI R ev. 4 sec "22" to North Carolina-South Carolina State Line, including all sloughs, sounds, inlets and connecting channels	SA	03-07-59	0.0	222.8	0.0	I	M	CAC	
Intracoastal Waterway	15-25b	From Cape Fear River Basin at Buoy FI R ev. 4 sec "22" to North Carolina-South Carolina State Line, including all sloughs, sounds, inlets and connecting channels	SA	03-07-59	0.0	102.1	0.0	I	M	CAC	
Intracoastal Waterway	15-25c	From Cape Fear River Basin at Buoy FI R ev. 4 sec "22" to North Carolina-South Carolina State Line, including all sloughs, sounds, inlets and connecting channels	SA	03-07-59	0.0	50.7	0.0	I	M	CAC	
Intracoastal Waterway	15-25d	From Cape Fear River Basin at Buoy FI R ev. 4 sec "22" to North Carolina-South Carolina State Line, including all sloughs, sounds, inlets and connecting channels	SA	03-07-59	0.0	315.6	0.0	I	M	PRO	100
Intracoastal Waterway	15-25e	From Cape Fear River Basin at Buoy FI R ev. 4 sec "22" to North Carolina-South Carolina State Line, including all sloughs, sounds, inlets and connecting channels	SA	03-07-59	0.0	358.6	0.0	I	M	CAO	11.6
Intracoastal Waterway	15-25f	From Cape Fear River Basin at Buoy FI R ev. 4 sec "22" to North Carolina-South Carolina State Line, including all sloughs, sounds, inlets and connecting channels	SA	03-07-59	0.0	81.5	0.0	I	M	CAO	11.6
Intracoastal Waterway	15-25g	From Cape Fear River Basin at Buoy FI R ev. 4 sec "22" to North Carolina-South Carolina State Line, including all sloughs, sounds, inlets and connecting channels	SA	03-07-59	0.0	44.6	0.0	I	M	PRO	100

Name	Assessment Unit Number	Description	Class	Subbasin	Stream Miles	Estuarine Acres	Coastline Miles	Rating	Basis	DEH Class	Percent Closed
Intracoastal Waterway	15-25h	From Cape Fear River Basin at Buoy FI R ev. 4 sec "22" to North Carolina-South Carolina State Line, including all sloughs, sounds, inlets and connecting channels	SA	03-07-59	0.0	22.5	0.0	I	M	PRO	100
Intracoastal Waterway	15-25i	From Cape Fear River Basin at Buoy FI R ev. 4 sec "22" to North Carolina-South Carolina State Line, including all sloughs, sounds, inlets and connecting channels	SA	03-07-59	0.0	65.8	0.0	I	M	CAO	11.6
Intracoastal Waterway	15-25j	From Cape Fear River Basin at Buoy FI R ev. 4 sec "22" to North Carolina-South Carolina State Line, including all sloughs, sounds, inlets and connecting channels	SA	03-07-59	0.0	165.2	0.0	I	M	PRO	100
Intracoastal Waterway	15-25k	From Cape Fear River Basin at Buoy FI R ev. 4 sec "22" to North Carolina-South Carolina State Line, including all sloughs, sounds, inlets and connecting channels	SA	03-07-59	0.0	89.2	0.0	I	M	CAO	9.9
Intracoastal Waterway	15-25l	From Cape Fear River Basin at Buoy FI R ev. 4 sec "22" to North Carolina-South Carolina State Line, including all sloughs, sounds, inlets and connecting channels	SA	03-07-59	0.0	55.0	0.0	I	M	CAO	9.6
Intracoastal Waterway	15-25m	From Cape Fear River Basin at Buoy FI R ev. 4 sec "22" to North Carolina-South Carolina State Line, including all sloughs, sounds, inlets and connecting channels	SA	03-07-59	0.0	53.0	0.0	S	M	APP	
Intracoastal Waterway	15-25n	From Cape Fear River Basin at Buoy FI R ev. 4 sec "22" to North Carolina-South Carolina State Line, including all sloughs, sounds, inlets and connecting channels	SA	03-07-59	0.0	159.5	0.0	S	M	APP	
Intracoastal Waterway	15-25o	From Cape Fear River Basin at Buoy FI R ev. 4 sec "22" to North Carolina-South Carolina State Line, including all sloughs, sounds, inlets and connecting channels	SA	03-07-59	0.0	63.6	0.0	I	M	PRO	100

Name	Assessment Unit Number	Description	Class	Subbasin	Stream Miles	Estuarine Acres	Coastline Miles	Rating	Basis	DEH Class	Percent Closed
Intracoastal Waterway	15-25p	From Cape Fear River Basin at Buoy FI R ev. 4 sec "22" to North Carolina-South Carolina State Line, including all sloughs, sounds, inlets and connecting channels	SA	03-07-59	0.0	115.5	0.0	S	M	APP	
Intracoastal Waterway	15-25q	From Cape Fear River Basin at Buoy FI R ev. 4 sec "22" to North Carolina-South Carolina State Line, including all sloughs, sounds, inlets and connecting channels	SA	03-07-59	0.0	8.9	0.0	I	M	PRO	100
Intracoastal Waterway	15-25r	From Cape Fear River Basin at Buoy FI R ev. 4 sec "22" to North Carolina-South Carolina State Line, including all sloughs, sounds, inlets and connecting channels	SA	03-07-59	0.0	67.5	0.0	I	M	PRO	100
Intracoastal Waterway	15-25s	From Cape Fear River Basin at Buoy FI R ev. 4 sec "22" to North Carolina-South Carolina State Line, including all sloughs, sounds, inlets and connecting channels	SA	03-07-59	0.0	0.5	0.0	I	M	PRO	100
Intracoastal Waterway	15-25t	From Cape Fear River Basin at Buoy FI R ev. 4 sec "22" to North Carolina-South Carolina State Line, including all sloughs, sounds, inlets and connecting channels	SA	03-07-59	0.0	292.8	0.0	S	M	APP	
Intracoastal Waterway	15-25u	From Cape Fear River Basin at Buoy FI R ev. 4 sec "22" to North Carolina-South Carolina State Line, including all sloughs, sounds, inlets and connecting channels	SA	03-07-59	0.0	403.5	0.0	I	M	PRO	100
Jinnys Branch	15-25-2-16-1-(2)	From Brunswick County SR 1143 to Saucepan Creek	SA	03-07-59	0.0	1.0	0.0	I	M	PRO	100
Kilbart Slough	15-25-4	From source to Intracoastal Waterway	SA	03-07-59	0.0	0.7	0.0	I	M	PRO	100
Lockwoods Creek	15-25-1-20	From source to Lockwoods Folly River	SA	03-07-59	0.2	0.0	0.0	I	M	PRO	100
Lockwoods Folly River	15-25-1-(16)a	From Brunswick County, SR 1200 to a line crossing Lockwood Folley River 520 meters north of Myrtle Point of the east shore to a point of the west shore 704 meters north of Mullet Creek.	SA	03-07-59	0.0	123.6	0.0	I	M	PRO	100

Name	Assessment Unit Number	Description	Class	Subbasin	Stream Miles	Estuarine Acres	Coastline Miles	Rating	Basis	DEH Class	Percent Closed
Lockwoods Folly River	15-25-1-(16)b	From a line crossing Lockwood Folly River 520 meters north of Myrtle Point of the east shore to a point of the west shore 704 meters north of Mullet Creek to a line crossing Lockwood Folly River 146 meters north of Genoes Point on the east shore to a point on the west shore 777 meters south of Mullet Creek.	SA	03-07-59	0.0	275.6	0.0	I	M	CAC	
Lockwoods Folly River	15-25-1-(16)c	From a line crossing Lockwood Folly River 146 meters north of Genoes Point on the east shore to a point on the west shore 777 meters south of Mullet Creek to a line crossing Lockwood Folly River 628 meters south of Genoes Point on the east shore to Gores Landing on the east shore.	SA	03-07-59	0.0	207.0	0.0	I	M	CAO	17.4
Lockwoods Folly River	15-25-1-(16)d	From a line crossing Lockwood Folly River 628 meters south of Genoes Point on the east shore to Gores Landing on the east shore to ICWW.	SA	03-07-59	0.0	53.1	0.0	S	M	APP	
Mill Creek	15-25-1-18-(2)	From Brunswick County SR 1112 to Lockwoods Folly River	SA	03-07-59	0.0	2.0	0.0	I	M	PRO	100
Montgomery Slough	15-25v	From Cape Fear River Basin at Buoy FI R ev. 4 sec "22" to North Carolina-South Carolina State Line, including all sloughs, sounds, inlets and connecting channels	SA	03-07-59	2.3	0.0	0.0	I	M	PRO	100
Mullet Creek	15-25-1-19	From source to Lockwoods Folly River	SA	03-07-59	0.0	5.7	0.0	I	M	PRO	100
Sams Branch	15-25-2-12-(2)	From proposed dam approximately 3/4 mile upstream from Shallotte River channel to Shallotte River	SA	03-07-59	0.6	0.0	0.0	I	M	PRO	100
Saucepan Creek	15-25-2-16	From source to Shallotte River	SA	03-07-59	0.0	62.6	0.0	I	M	PRO	100
Shallotte Creek	15-25-2-15-(3)	From Bell Branch to Shallotte River	SA	03-07-59	0.0	135.6	0.0	I	M	CAO	17
Shallotte River	15-25-2-(10)a	From mouth of Mill Pond to a line crossing the Shallotte River from a point 948 meters north of Shell Point on the east bank across to the south mouth of Middle Dam Creek.	SA	03-07-59	0.0	158.3	0.0	I	M	PRO	100



Name	Assessment Unit Number	Description	Class	Subbasin	Stream Miles	Estuarine Acres	Coastline Miles	Rating	Basis	DEH Class	Percent Closed
Shallotte River	15-25-2-(10)b	From a line crossing the Shallotte River from a point 948 meters north of Shell Point on the east bank across to the south mouth of Middle Dam Creek to a line crossing the Shallotte River 459 meters north of Shell Point on the east bank across to a point 651 meters north of the Swash.	SA	03-07-59	0.0	59.4	0.0	I	M	CAC	
Shallotte River	15-25-2-(10)c	From a line crossing the Shallotte River 459 meters north of Shell Point on the east bank across to a point 651 meters north of the Swash to a line crossing the Shallotte River from Shell Point across to the Swash.	SA	03-07-59	0.0	89.0	0.0	I	M	CAO	17.6
Shallotte River	15-25-2-(10)d	From a line crossing the Shallotte River from Shell Point across to the Swash to the Intracoastal Waterway.	SA	03-07-59	0.0	340.6	0.0	I	M	CAO	17
Spring Creek	15-25-1-21	From source to Lockwoods Folly River	SA	03-07-59	0.0	2.4	0.0	I	M	PRO	100
The Mill Pond	15-25-2-11-(2)	From a point 1.0 mile below Brunswick County SR 1145 to Shallotte River	SA	03-07-59	0.0	2.8	0.0	I	M	PRO	100
The Swash	15-25-2-14	From source to Shallotte River	SA	03-07-59	0.0	3.9	0.0	I	M	CAO	17

**NOTES**

"Rating" = Use Support Rating Problem Parameter for all impaired Class SA waters is fecal coliform bacteria

"Basis" = Rating basis

**ABBREVIATION KEY**

I = Impaired

S = Supporting

M = Monitored

APP = Approved

CAO = Conditionally Approved-Open

CAC = Conditionally Approved-Closed

PRO = Prohibited

Name	Assessment Unit Number	Description	Class	Subbasin	Stream Miles	Coastline Miles	Rating	Basis	Problem Parameter	Major Source	Potential Source(s)
Lumber River	14-(13)e	From below WWTP at SR 1620/72 Robeson County to NC 74 Robeson County	C Sw	03-07-51	21.5		I	M			
Atlantic Ocean	99-(1)	The waters of the Atlantic Ocean contiguous to that portion of the Waccamaw River Drainage Area of the Lumber River Basin extending from the Cape Fear River Basin to the North Carolina-South Carolina State Line	SB	03-07-59		25.6	I	M			
<b>NOTES</b>											
"Rating" = Use Support Rating											
"Basis" = Rating basis											
<b>ABBREVIATION KEY</b>											
M = Monitored											
S = Supporting											
I = Impaired											
NR = Not Rated											

# **Appendix IV**

## **303(d) Listing and Reporting Methodology**



## **Integrated 305(b) and 303(d) Report Summary**

The *North Carolina Water Quality Assessment and Impaired Waters List* is an integrated report that includes both the 305(b) and 303(d) reports of previous years. The *305(b) Report* is compiled biennially to update the assessment of water quality in North Carolina and to meet the Section 305(b) reporting requirement of the Clean Water Act. The 305(b) reports present how well waters support designated uses (e.g., swimming, aquatic life support, water supply), as well as likely causes (e.g., sediment, nutrients) and potential sources of impairment. The term "Use Support" refers to the process mandated by 305(b). The *303(d) List* is a comprehensive public accounting of all Impaired waterbodies that is derived from the 305(b) Report/Use Support. An Impaired waterbody is one that does not meet water quality uses, such as water supply, fishing or propagation of aquatic life. Best professional judgement along with numeric and narrative standards criteria and anti-degradation requirements defined in 40 CFR 131 are considered when evaluating the ability of a waterbody to serve its uses.

Section 303(d) of the federal Clean Water Act (CWA) which Congress enacted in 1972 requires States, Territories and authorized Tribes to identify and establish a priority ranking for waterbodies for which technology-based effluent limitations required by Section 301 are not stringent enough to attain and maintain applicable water quality standards, establish total maximum daily loads (TMDLs) for the pollutants causing impairment in those waterbodies, and submit, from time to time, the list of Impaired waterbodies and TMDLs to the US Environmental Protection Agency (EPA). Current federal rules require states to submit 303(d) lists biennially, by April 1<sup>st</sup> of every even numbered year. For 2002, EPA delayed the submittal until October 1, 2002 (EPA, 2001a). EPA is required to approve or disapprove the state-developed 303(d) list within 30 days. For each water quality limited segment Impaired by a pollutant and identified in the 303(d) list, a Total Maximum Daily Load (TMDL) must be developed. TMDLs are not required for waters Impaired by pollution.

North Carolina submitted a combined 305(b) and 303(d) Integrated Report to EPA on October 2, 2002. The Integrated Report includes descriptions of monitoring programs, the use support methodology, and the Impaired waters list. New guidance from EPA places all waterbody assessment units, or segments, into one unique assessment category (EPA, 2001b). Although EPA specifies five unique assessment categories, North Carolina elects to use seven categories in order to maintain continuity with the 2000 North Carolina 303(d) list. Each category is described in detail below:

**Category 1: Attaining the water quality standard and no use is threatened.** This category consists of those waters where all applicable use support categories are rated "Fully Supporting". Data and information are available to support a determination that the water quality standards are attained and no use is threatened. Future monitoring data will be used to determine if the water quality standard continues to be attained.

**Category 2: Attaining some of the designated uses; no use is threatened; and insufficient or no data and information are available to determine if the remaining uses are attained or threatened.** This category consists of those waters where at least one of the applicable use support categories are rated "Fully Supporting" and the other use support categories are rated "Not Rated". Also included in this category are waters where at least one of the applicable use support categories, except Fish Consumption, are

rated "Fully Supporting"; the remaining applicable use support categories, except Fish Consumption, are rated "Not Rated"; and the Fish Consumption category is rated "Partially Supporting-Evaluated". Data and information are available to support a determination that some, but not all, uses are attained. Attainment status of the remaining uses is unknown because there are insufficient or no data or information. Future monitoring data will be used to determine if the uses previously found to be in attainment remain in attainment, and to determine the attainment status of those uses for which data and information were previously insufficient to make a determination.

**Category 3: Insufficient or no data and information to determine if any designated use is attained.** This category consists of those waters where all applicable use support categories, except Fish Consumption, are rated "Not Rated", and the Fish Consumption category is rated "Partially Supporting-Evaluated". Measured data or information to support an attainment determination for any use are not available. Supplementary data and information, or future monitoring, will be required to assess the attainment status.

**Category 4: Impaired or threatened for one or more designated uses but does not require the development of a TMDL.** This category contains three distinct sub-categories:

**Category 4a: TMDL has been completed.** This category consists of those waters for which EPA has approved or established a TMDL and water quality standards have not yet been achieved. Monitoring data will be considered when evaluating Category 4a waterbodies for potential delisting.

**Category 4b: Other pollution control requirements are reasonably expected to result in the attainment of the water quality standard in the near future.** This category consists of those waters for which TMDLs will not be attempted because other required regulatory controls (e.g., NPDES permit limits, Stormwater Program rules, etc.) are expected to attain water quality standards by the next regularly scheduled listing cycle. Future monitoring will be used to verify that the water quality standard is attained as expected.

**Category 4c: Impairment is not caused by a pollutant.** This category consists of waters that are Impaired by pollution, not by a pollutant. EPA defines pollution as "The man-made or man-induced alteration of the chemical, physical, biological and radiological integrity of the water." EPA believes that in situations where the impairment is not caused by a pollutant, a TMDL is generally not the appropriate solution to the problem. Future monitoring will be used to confirm that there continues to be no pollutant-caused impairment and to support water quality management actions necessary to address the cause(s) of the impairment.

**Category 5: Impaired for one or more designated uses by a pollutant(s) and requires a TMDL.** This category consists of those waters that are Impaired by a pollutant and the proper technical conditions exist to develop TMDLs. As defined by the EPA, the term pollutant means "dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial,

municipal, and agricultural waste discharged into the water." When more than one pollutant is associated with the impairment of a single waterbody in this category, the water will remain in Category 5 until TMDLs for all listed pollutants have been completed and approved by the EPA.

**Category 6: Impaired based on biological data.** This category consists of waters historically referred to as "Biologically Impaired" waterbodies; these waterbodies have no identified cause(s) of impairment although aquatic life impacts have been documented. Identification of the cause(s) of impairment will precede movement of these waters to Category 5 or Category 4c of the integrated list. EPA has recognized in the past that in specific situations the data are not available to develop TMDLs. Data collection and analysis will be performed in an attempt to determine the cause(s) of impairment.

**Category 7: Impaired, but the proper technical conditions do not yet exist to develop a TMDL.** As described in the Federal Register, "proper technical conditions refers to the availability of the analytical methods, modeling techniques and data base necessary to develop a technically defensible TMDL. These elements will vary in their level of sophistication depending on the nature of the pollutant and characteristics of the segment in question" (43 FR 60662, December 28, 1978). These are waters that would otherwise be in Category 5 of the integrated list. As previously noted, EPA has recognized that in some specific situations the data, analyses or models are not available to establish a TMDL. North Carolina seeks EPA technical guidance in developing technically defensible TMDLs for these waters. Open water fecal coliform Impaired shellfishing waters are included in this category.

For this integrated list, Categories 1 and 2 are considered fully supporting any assessed uses. This portion of the integrated list is extensive (thousands of segments); thus, a printed copy is not included in this document. A table of waters on Categories 1 through 3 is available for downloading on the DWQ website ([http://h2o.enr.state.nc.us/tmdl/General\\_303d.htm](http://h2o.enr.state.nc.us/tmdl/General_303d.htm)). Categories 4, 5, 6 and 7 contain those assessment units that have been determined to be Impaired in North Carolina. **Therefore, Categories 4, 5, 6 and 7 constitute the 2002 North Carolina 303(d) List for the State of North Carolina.**

### **Prioritization of Impaired Waters**

North Carolina has developed a priority ranking scheme that reflects the relative value and benefits those waterbodies provide to the state. The priority ranking system is designed to take into account the severity of the impairment, especially threats to human health and endangered species, and the designated uses of the waterbody as required by CWA 303(d)(1)(A). Since other agencies and local governments also use this ranking to direct resources and funding, the priority ranking system has intentionally not included factors to reflect the availability of DWQ resources to address either TMDL development schedules or restoration.

A priority of High, Medium or Low has been assigned to all waterbodies in Categories 4b, 5, 6 and 7 of the integrated list. A high priority is assigned to all waterbodies that are classified as water supplies. A high priority is also automatically assigned to all waterbodies harboring species listed as endangered or threatened under the federal Endangered Species Act (ESA). A medium priority has minimally been assigned to waters harboring state listed endangered and

threatened species. As a way of addressing anti-degradation concerns, classified outstanding resource waters and high quality waters start at the medium priority.

### **Scheduling TMDLs**

Category 5 waters, those for which a TMDL is needed, are at many different stages on the path to an approved TMDL. Some require additional data collection to adequately define the problem in TMDL terms. Some require more outreach to increase stakeholder involvement. Others need to have a technical strategy budgeted, funded and scheduled. Some are ready for EPA submittal.

North Carolina has prioritized TMDL development for waters Impaired due to bacteria. The approach of prioritizing TMDL development based on pollutant has been successfully used in other states. Limited resources are used more effectively with a focus on a particular pollutant. Waters Impaired by other pollutants (i.e., not bacteria) are not excluded from the schedule. However, the majority of waters prioritized for the next few years are associated with bacterial contamination.

The movement of waters from Category 6 (Impaired based on biological data) to either Category 5 or 4c will require a large allocation of resources. North Carolina has used biological data to place the majority of waters on the 303(d) list. Additional consideration and data collection are necessary if the establishment of a TMDL for waters on Category 6 is to be expected. It is important to understand that the identification of waters in Category 6 does not mean that they are low priority waters. The assessment of these waters is a high priority for the State of North Carolina. However, it may take significant resources and time to determine the cause of impairment. Assigning waters to Category 6 is a declaration of the need for more data and time to adequately define the problems and whether they are affected by pollution, pollutants or a combination. Scheduling these waters for TMDL development prior to determining the causes of impairment is misleading and counterproductive.

During this listing cycle, significant resources and a grant from the Clean Water Management Trust Fund were utilized to study multiple waters that were considered Impaired based on biological data. One goal of this project was to determine the cause of impairment for these waters. Several of these studies have been completed and causes have been identified. These waters will now move from Category 6 to other locations within the integrated list.

### **Delisting Waters**

In general, waters will move from Categories 4, 5, 6 or 7 when data show that a water is fully supporting its uses. In some cases, mistakes have been discovered in the original listing decision and the mistakes are being corrected. Waters appearing on the previously approved Impaired waters list will be moved to Categories 1, 2 or 3 under the following circumstances:

- An updated 305(b) use support rating of Supporting, as described in the basinwide management plans.
- Applicable water quality standards are being met (i.e., no longer Impaired for a given pollutant) as described in either basinwide management plans or in technical memoranda.
- The basis for putting the water on the list is determined to be invalid (i.e., was mistakenly identified as Impaired in accordance with 40 CFR 130.7(b)(6)(iv) and/or *National Clarifying*



*Guidance for State and Territory 1998 Section 303(d) Listing Decisions.* Robert Wayland, III, Director. Office of Wetlands, Oceans and Watersheds. Aug 27, 1997).

- A water quality variance has been issued for a specific standard (e.g., chloride).
- Removal of fish consumption advisories or modification of fish eating advice.
- Typographic listing mistakes (i.e., the wrong water was identified).



## **Appendix V**

### **Lumber River Basin Workshop Summaries**



### Issues Associated with Specific Waters of the Lumber River Basin

Water or Area	Subbasin	Issue	Workshop
Naked Creek	03-07-50	Mining operation in headwaters.	Southern Pines
Lumber River	03-07-51	Salvage yard in floodplain of HQW portion of river, (west of I-95).	Southern Pines
Lumber River	03-07-51	Timber harvesting practices, removal of buffers.	Southern Pines
Pinebluff Lake	03-07-50	High levels of E. Coli from failing septic systems.	Southern Pines
Lumber River	03-07-51	Need for special monitoring during drought conditions.	Southern Pines
Robeson County	03-07-51, 52, 53, 54 & 55	Straight piping/failing septic systems.	Southern Pines
White Marsh	03-07-58	Loss of wetlands.	Bolivia
Gapway Swamp	03-07-51	Channelization.	Bolivia
Dunn Swamp	03-07-51	Channelization.	Bolivia
Shallotte River	03-07-59	Development impacts.	Bolivia
Lockwoods Folly River	03-07-59	Development impacts and natural flushing problems at the mouth.	Bolivia
Waccamaw River and Lake Waccamaw	03-07-56 & 57	Develop a trace system and identify corridors ½ - 1 mile and put in protection measures (i.e., buy-out, education).	Bolivia
Gum Swamp	03-07-57	Beavers. Get Beaver Management Assistant Program more staff.	Bolivia
Calabash River	03-07-59	Fecal coliform bacteria problems.	Bolivia
Caw Caw Swamp	03-07-57	Sedimentation, bulldozing stream ditches, nutrients.	Bolivia
Big Swamp	03-07-53	Logging of buffers, Alligator weed.	Southern Pines
Ocean Isle Beach	03-07-59	Bulkheads and canals caving in. Town council has committee to work on this.	Bolivia
Green Swamp	03-07-56	Alteration of hydrology.	Bolivia

### Issues Related to Urbanization and Land Use Changes Basinwide

Specific Issue	Recommendation	Workshop
Lack of coordinated planning		Southern Pines
Destruction of wetlands	Restoration efforts.	Southern Pines and Bolivia
Need for grassroots and nonprofit organizations		Southern Pines
Need for canoe/boating accesses		Southern Pines
Increasing impervious surface	Tight zoning and better enforcement. Promotion of low impact development.	Southern Pines and Bolivia
DOT projects and lack of sedimentation control	Better use of BMPs and increase size of culverts.	Southern Pines and Bolivia
Golf course nutrient and chemical runoff		Southern Pines and Bolivia
Hydromodification		Southern Pines and Bolivia
Lack of defining timber harvesting versus development	NC Forestry Service guidelines need to be reassessed and become law.	Southern Pines
Stormwater runoff	More regional approach. Development of stormwater utilities.	Southern Pines and Bolivia
Adverse weather and hurricanes	Better planning in reference to wastewater and stormwater.	Bolivia

### Issues Related to Water Supply Quantity and Protection

Issue	Workshop
Lack of planning by local governments to provide water for future needs.	Southern Pines
Low groundwater levels – high withdrawal.	Southern Pines
Hog operations' lagoons leaking to groundwater/surface water.	Southern Pines

### Issues Related to Enforcement, Permitting, Rule Making and Monitoring

Specific Issue	Recommendation	Workshop
Noxious weeds, Alligator weed	Need to monitor. Get money to get rid of noxious weeds.	Southern Pines
BMPs	Need to retrofit stormwater BMPs. Need better enforcement with greater penalties. Better maintenance and construction.	Southern Pines
Straight piping/failing septic systems		Southern Pines
General noncompliance with existing rules	Provide performance information and more research on efficiency.	Southern Pines
Animal operations nutrient inputs		
Lack of adequate number of inspections		Southern Pines
Lack of appropriate stormwater management		Southern Pines
Mercury and atmospheric deposition		Southern Pines and Bolivia

### Issues Related to Funding Sources and Education

Specific Issue	Recommendation	Workshop
Lack of education about water quality	More workshops/seminars/specific programs.	Southern Pines
Straight piping/failing septic systems	Homeowners' responsibility.	Southern Pines
Lack of understanding of who to contact regarding development and timber harvesting		Southern Pines
Sewer systems	County/State to provide grant funds to help get towns tied in with central sewer systems and grant writers and locating grant resources.	Southern Pines and Bolivia
Residential lawn care use	More specifications.	Bolivia
Media coverage	Have better media coverage about water quality educational programs.	Bolivia





## **Appendix VI**

### **Lumber River Basin Nonpoint Source Program Description and Contacts**



## Statewide Nonpoint Source Management Program Description

The North Carolina Nonpoint Source Management Program consists of a broad framework of federal, state and local resource and land management agencies. More than 2,000 individuals administer programs that are directly related to nonpoint source pollution management within the state. A range of responsibilities have been delegated to county or municipal programs including the authority to inspect and permit land clearing projects or septic system performance. In the field of agriculture, a well established network of state and federal agricultural conservationists provide technical assistance and program support to individual farmers.

Staff in the DWQ Water Quality Section's Planning Branch lead the Nonpoint Source Management Program, working with various agencies to insure that program goals are incorporated into individual agencies' management plans. The goals include:

1. Coordinate implementation of state and federal initiatives addressing watershed protection and restoration.
2. Continue to target geographic areas and waterbodies for protection based upon best available information.
3. Strengthen and improve existing nonpoint source management programs.
4. Develop new programs that control nonpoint sources of pollution not addressed by existing programs.
5. Integrate the NPS Program with other state programs and management studies (e.g., Albemarle-Pamlico National Estuary Program).
6. Monitor the effectiveness of BMPs and management strategies, both for surface water and groundwater quality.

Coordination between state agencies is achieved through reports in the *North Carolina Nonpoint Source Management Program Update*. Reports are intended to keep the program document current and develop a comprehensive assessment identifying the needs of each agency to meet the state nonpoint source program goals. Annual reports are developed to describe individual program priorities, accomplishments, significant challenges, issues yet to be addressed, and resource needs. A copy of the latest Annual Report is available online at [http://h2o.enr.state.nc.us/nps/nps\\_mp.htm](http://h2o.enr.state.nc.us/nps/nps_mp.htm).

The nature of nonpoint source pollution is such that involvement at the local level is imperative. Basinwide water quality plans identify watersheds that are impaired by nonpoint sources of pollution. Identification, status reports and recommendations are intended to provide the best available information to local groups and agencies interested in improving water quality. The plans also make available information regarding federal, state and local water quality initiatives aimed at reducing or preventing nonpoint source pollution.

The following table is a comprehensive guide to contacts within the state's Nonpoint Source Management Program. For more information, contact Alan Clark at (919) 733-5083, ext. 570. Most employees of the Department of Environment and Natural Resources, including the Division of Water Quality, Division of Land Resources and Division of Forest Resources, can be reached by email using the following formula: [firstname.lastname@ncmail.net](mailto:firstname.lastname@ncmail.net).

## Agriculture

### US Department of Agriculture Natural Resources Conservation Service (NRCS):

This agency was formerly called the Soil Conservation Service. NRCS district conservationists:

- Certify waste management plans for animal operations.
- Provide certification training for swine waste applicators.
- Work with landowners on private lands to conserve natural resources and install BMPs.
- Help farmers and ranchers develop conservation systems unique to their land and needs.
- Administer several federal agricultural cost share and incentive programs.
- Assist rural and urban communities to conserve and protect natural resources.
- Conduct soil surveys and offer farmers technical assistance on wetlands identification.

<u>County/Area</u>	<u>Contact Person</u>	<u>Phone</u>	<u>Address</u>
Area 2	Michael E. Sugg	704-637-2400	530 W. Innes St., Salisbury 28144
Area 3	William J. Harrell	919-751-0976	208 Mallory St., Suite C, Goldsboro 27534
Bladen	Christopher W. Bordeaux	910-862-3179	Ag. Services Center, Ice Plant Rd., Room 122, Elizabethtown 28337
Brunswick	Eric West	910-253-2830	10 Referendum Dr., Bolivia 28422
Columbus	Donna G. Register	910-642-2196	45 Government Complex Rd., Suite B, Whiteville 28472
Hoke	John M. Ray, Jr.	910-875-8685	122 W. Elwood Ave., Room 202, Raeford 28376
Montgomery	Renessa Hardy-Brown	910-572-2700	227-D N. Main St., Troy 27371
Moore	Angela D. Little	910-947-5183	707 Pinehurst Ave., Ag. Center Carthage 28372
Richmond	Vilma Mendez-Colombani	910-997-8244	123 Caroline St., Suite 300, Rockingham 28379
Robeson	Edward L. Holland	910-739-5478	440 Caton Rd, Lumberton 28358-0450
Scotland	Edward L. Holland	910-277-2433	231 E. Cronly St., Suite 800, Laurinburg 28352

### County Soil and Water Conservation Districts:

District technicians:

- Administer the *Agriculture Cost Share Program for Nonpoint Source Pollution Control*.
- Identify areas needing soil and/or water conservation treatment.
- Allocate cost share resources and sign cost share contracts with landowners.
- Provide technical assistance for planning and implementation of BMPs.
- Encourage the use of appropriate BMPs to protect water quality.

<u>County</u>	<u>District Chairman</u>	<u>Phone</u>	<u>Address</u>
Bladen	Ronald J. Allen	910-648-6077	6593 Center Rd., Bladenboro 28320
Brunswick	Bryan R. Smith	910-287-3315	7520 N. Fireway Rd., Longwood 28452
Columbus	Bobby N. Stanley	910-653-2925	10571 Clarendon-Chadbourn Rd., Clarendon 28432
Hoke	Joanne H. Hendrix	910-875-2921	5604 Fayetteville Rd., Raeford 28376
Montgomery	Don Thompson	910-572-3126	271 Brewer Rd., Mount Gilead 27306
Moore	Nowell Brown	910-947-5920	316 Alston House, Sanford 27330-8713
Richmond	Myers Waddell	910-895-2865	1116 Ann St., Rockingham 28379
Robeson	William A. Davis	910-422-3551	734 McLeod Rd., Rowland 28358
Scotland	T. G. Gibson, III	910-368-3421	PO Box 165, Gibson 28343-0165

Agriculture (con't)			
<b>NC Division of Soil and Water Conservation (DSWC):</b>			
DSWC staff:			
<ul style="list-style-type: none"> <li>• Administer the <i>Agriculture Cost Share Program for Nonpoint Source Pollution Control</i> (ACSP).</li> <li>• Allocate ACSP funds to the Soil and Water Conservation Districts.</li> <li>• Provide administrative and technical assistance related to soil science and engineering.</li> <li>• Distribute Wetlands Inventory maps for a small fee.</li> </ul>			
<u>Office/Area</u>	<u>Contact</u>	<u>Phone</u>	<u>Address</u>
Central Office	Deborah Gaul	919-715-6100	512 N. Salisbury St., Raleigh 27626
Area 8	Ralston James	704-663-1699	919 N. Main St., Mooresville 28115
Area 7	Jerry Raynor	910-486-1541	Wachovia Bldg., # 714, Fayetteville 28301
<b>NC Department of Agriculture (NCDA) Regional Agronomists:</b>			
NCDA technical specialists:			
<ul style="list-style-type: none"> <li>• Certify waste management plans for animal operations.</li> <li>• Provide certification training for swine waste applicators.</li> <li>• Track and monitor the use of nutrients on agricultural lands.</li> <li>• Operate the state <i>Pesticide Disposal Program</i>.</li> <li>• Enforce the state pesticide handling and application laws.</li> </ul>			
<u>Office</u>	<u>Contact</u>	<u>Phone</u>	<u>Address</u>
Central Office	Tom Ellis	919-733-7125	Box 27647, Raleigh 27611
Regional Office	Rick Morris	910-866-5485	3184 Old NC 41, Bladenboro 28320
	David Dycus	919-776-9338	3996 Center Church Road, Sanford 27330
	Tim Hall	910-324-9924	PO Box 444, Richlands 28574
Education			
<b>NC State University Cooperative Extension Service (CES):</b>			
CES staff provide practical, research-based information and programs to help individuals, families, farms, businesses and communities.			
<u>County</u>	<u>Contact Person</u>	<u>Phone</u>	<u>Address</u>
Bladen	Kent Wooten	910-862-4591	450 Smith Dr. Circle, Elizabethtown 28337
Brunswick	Martha Warner	910-253-2610	Government Ctr., PO Box 109, Bolivia 28422
Columbus	Jacqueline Roseboro	910-640-6606	PO Box 569, Whiteville 28472
Hoke	Clinton A. McRae	910-671-3276	116 W. Prospect Ave., Raeford 28376
Montgomery	Susan Hamilton	910-576-6011	203 W. Main St., Troy 27371
Moore	Bert Coffe	910-947-3188	707 Pinehurst Ave., Ag. Center, Carthage 28372
Richmond	Mary B. Bowles	910-997-8255	114 Franklin St., Rockingham 28379
Robeson	Everett Davis	910-671-3276	455 Caton Rd., Owens Ag. Center, Lumberton 28359-2280
Scotland	Cathy L. Graham	919-277-2422	231 E. Cronly St., Laurinburg 28352

Forestry			
<b>NC Division of Forest Resources (DFR):</b>			
DFR staff:			
<ul style="list-style-type: none"> <li>Develop, protect and manage the multiple resources of North Carolina's forests through professional stewardship.</li> <li>Enhance the quality of life for our citizens while ensuring the continuity of these vital resources.</li> </ul>			
<u>Office/District</u>	<u>Contact Title</u>	<u>Phone</u>	<u>Address</u>
Central Office	Forestry NPS Unit	919-733-2162	512 N. Salisbury St., Raleigh 27604
District 8	Water Quality	910-642-5093	1413 Chadburn Hwy., Whiteville 28472
District 6	Assistant District Forester	910-437-2620	221 Airport Rd., Fayetteville 28306
District 3	Assistant District Forester	910-997-9220	1163 N. US Hwy. 1, Rockingham 28379
General Water Quality			
<b>NC Division of Water Quality, Water Quality Section (DWQ):</b>			
DWQ Water Quality Section staff:			
<ul style="list-style-type: none"> <li>Implement water quality protection from point sources (municipal and industrial wastewater discharges) and from nonpoint sources (for example, land application of waste).</li> <li>Issue permits for both wastewater discharges and on-site wastewater treatment systems.</li> <li>Conduct compliance inspections.</li> <li>Monitor water quality throughout the state.</li> <li>Administer Section 319 grant projects statewide.</li> </ul>			
<u>Region</u>	<u>Contact Person</u>	<u>Phone</u>	<u>Address</u>
Fayetteville Region	Paul Rawls	910-486-1541	225 Green St., Suite 714, Fayetteville 28301
Wilmington Region	Rick Shiver	910-395-3900	127 Cardinal Dr. Ext., Wilmington 28405
<b>NC Wildlife Resources Commission (WRC):</b>			
WRC staff:			
<ul style="list-style-type: none"> <li>Manage, restore, cultivate, conserve, protect and regulates the state's wildlife resources.</li> <li>Administer the laws enacted by the General Assembly relating to game and non-game freshwater fish, and other wildlife resources in a constructive, comprehensive, continuing and economical manner.</li> </ul>			
<u>Office/Region</u>	<u>Contact Person</u>	<u>Phone</u>	<u>Address</u>
Central Office	David Cox	919-528-9886	1721 Mail Service Center, Raleigh 27699-1721
District Office	Shannon Deaton	919-733-3633	1721 Mail Service Center, Raleigh 27699-1721

General Water Quality (con't)			
<b>US Army Corps of Engineers:</b>			
Corps staff:			
<ul style="list-style-type: none"> <li>Investigate, develop and maintain the nation's water and related environmental resources.</li> <li>Construct and operate projects for navigation, flood control, major drainage, shore and beach restoration and protection.</li> <li>Develop hydropower.</li> <li>Conserve and enhance water supplies, fish and wildlife and outdoor recreation.</li> <li>Respond to emergency relief activities directed by other federal agencies.</li> <li>Administer laws for the protection of navigable waters, emergency flood control and shore protection.</li> <li>Issue wetlands and 404 Federal Permits.</li> </ul>			
<u>Office/Region</u>	<u>Contact Person</u>	<u>Phone</u>	<u>Address</u>
Wilmington District	David Timpy	910-251-4745	PO Box 1890, Wilmington 28402-1890
<b>NC Division of Water Quality, Groundwater Section:</b>			
DWQ Groundwater Section staff:			
<ul style="list-style-type: none"> <li>Enforce groundwater quality protection standards and cleanup requirements.</li> <li>Review permits for wastes discharged to groundwater.</li> <li>Issue permits for well construction.</li> <li>Control underground injections.</li> <li>Administer and develop the well head protection program.</li> <li>Monitor ambient groundwater.</li> </ul>			
<u>Office/Region</u>	<u>Contact Person</u>	<u>Phone</u>	<u>Address</u>
Central Office	Carl Bailey	919-733-3221	2728 Capital Blvd., Raleigh 27604
Fayetteville Region	Art Barnhardt	910-486-1541	225 Green St., Fayetteville 28301-5043
Wilmington Region	Charlie Stehman	910-395-3900	127 Cardinal Dr. Ext., Wilmington 28405
Construction/Mining			
<b>NC Division of Land Resources (DLR):</b>			
DLR staff administer the NC Erosion and Sedimentation Control Program for construction and mining operations.			
<u>Office/Region</u>	<u>Contact Person</u>	<u>Phone</u>	<u>Address</u>
Central Office	Mell Nevils, Chief	919-733-4574	512 N. Salisbury St., Raleigh 27626
	Tracy Davis, Mining	919-733-4574	512 N. Salisbury St., Raleigh 27626
Fayetteville Region	Gerald Lee	910-486-1541	225 Green St., Fayetteville 28301-5043
Wilmington Region	Dan Sams	910-395-3900	127 Cardinal Dr. Ext., Wilmington 28405

Solid Waste			
<b>NC Division of Waste Management (DWM):</b>			
DWM staff:			
<ul style="list-style-type: none"> <li>Manage solid waste in a way that protects public health and the environment.</li> <li>Implement three programs – Hazardous Waste, Solid Waste, Superfund and the Resident Inspectors Program.</li> </ul>			
<u>Office/Region</u>	<u>Contact Person</u>	<u>Phone</u>	<u>Address</u>
Central Office	Brad Atkinson	919-733-0692	401 Oberlin Rd, Suite 150, Raleigh 27605
Fayetteville Region	Mark Fry	910-486-1541	225 Green St., Suite 714, Fayetteville 28301
Wilmington Region			
Wazard Waste	Bobby Nelms	910-395-3900	127 Cardinal Ext. Dr., Wilmington 28405
Solid Waste	John Crowder	910-395-3900	127 Cardinal Ext. Dr., Wilmington 28405
On-Site Wastewater Treatment			
<b>NC Division of Environmental Health (DEH) and County Health Departments:</b>			
DEH and County Health Department staff:			
<ul style="list-style-type: none"> <li>Safeguard life, promote human health, and protect the environment through modern environmental health science, the use of technology, rules, public education and dedication to the public trust.</li> <li>Train and delegate authority to local environmental health specialists concerning on-site wastewater.</li> <li>Conduct engineering reviews for wastewater systems and industrial process wastewater systems with below-ground discharges.</li> <li>Provide technical assistance to local health departments, state agencies and industry.</li> </ul>			
<u>County/Office</u>	<u>Contact Person</u>	<u>Phone</u>	<u>Address</u>
Central	Barbara Hartley-Grimes, PhD	919-715-0141	2728 Capital Blvd., Raleigh 27604
Bladen	Myra Johnson	910-862-6900	PO Box 1889, Elizabethtown 28337
Brunswick	Donald J. Yousey	910-253-2250	25 Courthouse Dr., NE Bolivia 28422
Columbus	Marian W. Duncan	910-640-6617	PO Box 810, Whiteville 28472
Hoke	Don Womble, MPH, R.S.	910-875-9014	429 E. Central Ave., Raeford 28376
Montgomery	Kathleen Devore-Jones	910-572-8175	217 S. Main St., Troy 27371
Moore	Robert R. Wittmann	910-947-6283	PO Box 279, Carthage 28327
Richmond	Tommy Jarrell	910-997-8320	125 Caroline St., Rockingham 28379
Robeson	William J. Smith	910-671-3200	460 Country Club Rd, Lumberton 28358
Scotland	Jane Murray	910-277-2492	PO Box 69, Laurinburg 28352

- DENR Fayetteville Region covers the following counties within the Lumber River basin: Bladen, Hoke, Montgomery, Moore, Richmond, Robeson and Scotland.
- DENR Wilmington Region covers the following counties within the Lumber River basin: Columbus and Brunswick.



# **Appendix VII**

## **Glossary of Terms and Acronyms**



# Glossary

§	Section.
30Q2	The minimum average flow for a period of 30 days that has an average recurrence of one in two years.
7Q10	The annual minimum 7-day consecutive low flow, which on average will be exceeded in 9 out of 10 years.
B (Class B)	Class B Water Quality Classification. This classification denotes freshwaters protected for primary recreation and other uses suitable for Class C. Primary recreational activities include frequent and/or organized swimming and other human contact such as skin diving and water skiing.
basin	The watershed of a major river system. There are 17 major river basins in North Carolina.
benthic macroinvertebrates	Aquatic organisms, visible to the naked eye (macro) and lacking a backbone (invertebrate), that live in or on the bottom of rivers and streams (benthic). Examples include, but are not limited to, aquatic insect larvae, mollusks and various types of worms. Some of these organisms, especially aquatic insect larvae, are used to assess water quality. See EPT index and bioclassification for more information.
benthos	A term for bottom-dwelling aquatic organisms.
best management practices	Techniques that are determined to be currently effective, practical means of preventing or reducing pollutants from point and nonpoint sources, in order to protect water quality. BMPs include, but are not limited to: structural and nonstructural controls, operation and maintenance procedures, and other practices. Often, BMPs are applied as system of practices and not just one at a time.
bioclassification	A rating of water quality based on the outcome of benthic macroinvertebrate sampling of a stream. There are five levels: Poor, Fair, Good-Fair, Good and Excellent.
BMPs	See <i>best management practices</i> .
BOD	Biochemical Oxygen Demand. A measure of the amount of oxygen consumed by the decomposition of biological matter or chemical reactions in the water column. Most NPDES discharge permits include a limit on the amount of BOD that may be discharged.
C (Class C)	Class C Water Quality Classification. This classification denotes freshwaters protected for secondary recreation, fishing, wildlife, fish and aquatic life propagation and survival, and others uses.
channelization	The physical alteration of streams and rivers by widening, deepening or straightening of the channel, large-scale removal of natural obstructions, and/or lining the bed or banks with rock or other resistant materials.
chlorophyll <i>a</i>	A chemical constituent in plants that gives them their green color. High levels of chlorophyll <i>a</i> in a waterbody, most often in a pond, lake or estuary, usually indicate a large amount of algae resulting from nutrient overenrichment or eutrophication.
coastal counties	Twenty counties in eastern NC subject to requirements of the Coastal Area Management Act (CAMA). They include: Beaufort, Bertie, Brunswick, Camden, Carteret, Chowan, Craven, Currituck, Dare, Gates, Hertford, Hyde, New Hanover, Onslow, Pamlico, Pasquotank, Pender, Perquimans, Tyrrell and Washington.
Coastal Plain	One of three major physiographic regions in North Carolina. Encompasses the eastern two-fifths of state east of the <i>fall line</i> (approximated by Interstate I-95).
conductivity	A measure of the ability of water to conduct an electrical current. It is dependent on the concentration of dissolved ions such as sodium, chloride, nitrates, phosphates and metals in solution.
degradation	The lowering of the physical, chemical or biological quality of a waterbody caused by pollution or other sources of stress.

DENR	Department of Environment and Natural Resources.
DO	Dissolved oxygen.
drainage area	An alternate name for a watershed.
DWQ	North Carolina Division of Water Quality, an agency of DENR.
dystrophic	Naturally acidic (low pH), "black-water" lakes which are rich in organic matter. Dystrophic lakes usually have low productivity because most fish and aquatic plants are stressed by low pH water. In North Carolina, dystrophic lakes are scattered throughout the Coastal Plain and Sandhills regions and are often located in marshy areas or overlying peat deposits. NCTSI scores are not appropriate for evaluating dystrophic lakes.
effluent	The treated liquid discharged from a wastewater treatment plant.
EMC	Environmental Management Commission.
EPA	United States Environmental Protection Agency.
EPT Index	This index is used to judge water quality based on the abundance and variety of three orders of pollution sensitive aquatic insect larvae: <u>E</u> phemeroptera (mayflies), <u>P</u> lecoptera (stoneflies) and <u>T</u> richoptera (caddisflies).
eutrophic	Elevated biological productivity related to an abundance of available nutrients. Eutrophic lakes may be so productive that the potential for water quality problems such as algal blooms, nuisance aquatic plant growth and fish kills may occur.
eutrophication	The process of physical, chemical or biological changes in a lake associated with nutrient, organic matter and silt enrichment of a waterbody. The corresponding excessive algal growth can deplete dissolved oxygen and threaten certain forms of aquatic life, cause unsightly scums on the water surface and result in taste and odor problems.
fall line	A geologic landscape feature that defines the line between the piedmont and coastal plain regions. It is most evident as the last set of small rapids or rock outcroppings that occur on rivers flowing from the piedmont to the coast.
FS	Fully supporting. A rating given to a waterbody that fully supports its designated uses and generally has good or excellent water quality.
GIS	Geographic Information System. An organized collection of computer hardware, software, geographic data and personnel designed to efficiently capture, store, update, manipulate, analyze and display all forms of geographically referenced information.
habitat degradation	Identified where there is a notable reduction in habitat diversity or change in habitat quality. This term includes sedimentation, bank erosion, channelization, lack of riparian vegetation, loss of pools or riffles, loss of woody habitat, and streambed scour.
headwaters	Small streams that converge to form a larger stream in a watershed.
HQW	High Quality Waters. A supplemental surface water classification.
HU	Hydrologic unit. See definition below.
<i>Hydrilla</i>	The genus name of an aquatic plant - often considered an aquatic weed.
hydrologic unit	A watershed area defined by a national uniform hydrologic unit system that is sponsored by the Water Resources Council. This system divides the country into 21 regions, 222 subregions, 352 accounting units and 2,149 cataloging units. A hierarchical code consisting of two digits for each of the above four levels combined to form an eight-digit hydrologic unit (cataloging unit). An eight-digit hydrologic unit generally covers an average of 975 square miles. There are 54 eight-digit hydrologic (or cataloging) units in North Carolina. These units have been further subdivided into eleven and fourteen-digit units.
hypereutrophic	Extremely elevated biological productivity related to excessive nutrient availability. Hypereutrophic lakes exhibit frequent algal blooms, episodes of low dissolved oxygen or periods when no oxygen is present in the water, fish kills and excessive aquatic plant growth.
impaired	Term that applies to a waterbody that has a use support rating of partially supporting (PS) or not supporting (NS) its uses.

impervious	Incapable of being penetrated by water; non-porous.
kg	Kilograms. To change kilograms to pounds multiply by 2.2046.
lbs	Pounds. To change pounds to kilograms multiply by 0.4536.
loading	Mass rate of addition of pollutants to a waterbody (e.g., kg/yr)
macroinvertebrates	Animals large enough to be seen by the naked eye (macro) and lacking backbones (invertebrate).
macrophyte	An aquatic plant large enough to be seen by the naked eye.
mesotrophic	Moderate biological productivity related to intermediate concentrations of available nutrients. Mesotrophic lakes show little, if any, signs of water quality degradation while supporting a good diversity of aquatic life.
MGD	Million gallons per day.
mg/l	Milligrams per liter (approximately 0.00013 oz/gal).
NCIBI	North Carolina Index of Biotic Integrity. A measure of the community health of a population of fish in a given waterbody.
NH <sub>3</sub> -N	Ammonia nitrogen.
nonpoint source	A source of water pollution generally associated with rainfall runoff or snowmelt. The quality and rate of runoff of NPS pollution is strongly dependent on the type of land cover and land use from which the rainfall runoff flows. For example, rainfall runoff from forested lands will generally contain much less pollution and runoff more slowly than runoff from urban lands.
NPDES	National Pollutant Discharge Elimination System.
NPS	Nonpoint source.
NR	Not rated. A waterbody that is not rated for use support due to insufficient data.
NS	Not supporting. A rating given to a waterbody that does not support its designated uses and has poor water quality and severe water quality problems. Both PS and NS are called impaired.
NSW	Nutrient Sensitive Waters. A supplemental surface water classification intended for waters needing additional nutrient management due to their being subject to excessive growth of microscopic or macroscopic vegetation. Waters classified as NSW include the Neuse, Tar-Pamlico and Chowan River basins; the New River watershed in the White Oak basin; and the watershed of B. Everett Jordan Reservoir (including the entire Haw River watershed).
NTU	Nephelometric Turbidity Units. The units used to quantify turbidity using a turbidimeter. This method is based on a comparison of the intensity of light scattered by the sample under defined conditions with the intensity of the light scattered by a standard reference suspension under the same conditions.
oligotrophic	Low biological productivity related to very low concentrations of available nutrients. Oligotrophic lakes in North Carolina are generally found in the mountain region or in undisturbed (natural) watersheds and have very good water quality.
ORW	Outstanding Resource Waters. A supplemental surface water classification intended to protect unique and special resource waters having excellent water quality and being of exceptional state or national ecological or recreational significance. No new or expanded wastewater treatment plants are allowed, and there are associated stormwater runoff controls enforced by DWQ.
pH	A measure of the concentration of free hydrogen ions on a scale ranging from 0 to 14. Values below 7 and approaching 0 indicate increasing acidity, whereas values above 7 and approaching 14 indicate a more basic solution.
phytoplankton	Aquatic microscopic plant life, such as algae, that are common in ponds, lakes, rivers and estuaries.

Piedmont	One of three major physiographic regions in the state. Encompasses most of central North Carolina from the Coastal Plain region (near I-95) to the eastern slope of the Blue Ridge Mountains region.
PS	Partially supporting. A rating given to a waterbody that only partially supports its designated uses and has fair water quality and severe water quality problems. Both PS and NS are called impaired.
riparian zone	Vegetated corridor immediately adjacent to a stream or river. See also SMZ.
river basin	The watershed of a major river system. North Carolina is divided into 17 major river basins: Broad, Cape Fear, Catawba, Chowan, French Broad, Hiwassee, Little Tennessee, Lumber, Neuse, New, Pasquotank, Roanoke, Savannah, Tar-Pamlico, Watauga, White Oak and Yadkin River basins.
river system	The main body of a river, its tributary streams and surface water impoundments.
runoff	Rainfall that does not evaporate or infiltrate the ground, but instead flows across land and into waterbodies.
SA	Class SA Water Classification. This classification denotes saltwaters that have sufficient water quality to support commercial shellfish harvesting.
SB	Class SB Water Classification. This classification denotes saltwaters with sufficient water quality for frequent and/or organized swimming or other human contact.
SC	Class SC Water Classification. This classification denotes saltwaters with sufficient water quality to support secondary recreation and aquatic life propagation and survival.
sedimentation	The sinking and deposition of waterborne particles (e.g., eroded soil, algae and dead organisms).
silviculture	Care and cultivation of forest trees; forestry.
SOC	Special Order by Consent. An agreement between the Environmental Management Commission and a permitted discharger found responsible for causing or contributing to surface water pollution. The SOC stipulates actions to be taken to alleviate the pollution within a defined time. The SOC typically includes relaxation of permit limits for particular parameters, while the facility completes the prescribed actions. SOC's are only issued to facilities where the cause of pollution is not operational in nature (i.e., physical changes to the wastewater treatment plant are necessary to achieve compliance).
streamside management zone (SMZ)	The area left along streams to protect streams from sediment and other pollutants, protect streambeds, and provide shade and woody debris for aquatic organisms.
subbasin	A designated subunit or subwatershed area of a major river basin. Subbasins typically encompass the watersheds of significant streams or lakes within a river basin. Every river basin is subdivided into subbasins ranging from one subbasin in the Watauga River basin to 24 subbasins in the Cape Fear River basin. There are 133 subbasins statewide. These subbasins are not a part of the national uniform hydrologic unit system that is sponsored by the Water Resources Council (see <i>hydrologic unit</i> ).
Sw	Swamp Waters. A supplemental surface water classification denoting waters that have naturally occurring low pH, low dissolved oxygen and low velocities. These waters are common in the Coastal Plain and are often naturally discolored giving rise to their nickname of "blackwater" streams.
TMDL	Total maximum daily load. The amount of a given pollutant that a waterbody can assimilate and maintain its uses and water quality standards.
TN	Total nitrogen.
TP	Total phosphorus.
tributary	A stream that flows into a larger stream, river or other waterbody.

trophic classification	Trophic classification is a relative description of a lake's biological productivity, which is the ability of the lake to support algal growth, fish populations and aquatic plants. The productivity of a lake is determined by a number of chemical and physical characteristics, including the availability of essential plant nutrients (nitrogen and phosphorus), algal growth and the depth of light penetration. Lakes are classified according to productivity: unproductive lakes are termed "oligotrophic"; moderately productive lakes are termed "mesotrophic"; and very productive lakes are termed "eutrophic".
TSS	Total Suspended Solids.
turbidity	An expression of the optical property that causes light to be scattered and absorbed rather than transmitted in straight lines through a sample. All particles in the water that may scatter or absorb light are measured during this procedure. Suspended sediment, aquatic organisms and organic particles such as pieces of leaves contribute to instream turbidity.
UT	Unnamed tributary.
watershed	The region, or land area, draining into a body of water (such as a creek, stream, river, pond, lake, bay or sound). A watershed may vary in size from several acres for a small stream or pond to thousands of square miles for a major river system. The watershed of a major river system is referred to as a basin or river basin.
WET	Whole effluent toxicity. The aggregate toxic effect of a wastewater measured directly by an aquatic toxicity test.
WS	Class WS Water Supply Water Classification. This classification denotes freshwaters used as sources of water supply. There are five WS categories. These range from WS-I, which provides the highest level of protection, to WS-V, which provides no categorical restrictions on watershed development or wastewater discharges like WS-I through WS-IV.
WWTP	Wastewater treatment plant.